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D. Saunders' Sons Pipe Threading and Cutting-Off Machines.

The engravings on this page represent two of the recently improved pipe threading machines, made by D. Saunders' Sons, Yonkers, N. Y., and designed especially for use in pipe mills where the work is continuous and severe. These machines are very powerful ones of the kind, and arranged for rapid use, requiring the least possible time for adjustment or changing work. With the chuck used for holding the pipe a simple movement of the lever grips or loosens it, without the necessity of stopping the machine. This movement, through a system of sliding blocks and levers, gives the required motion to the chuck jaws for one size of pipe, and at the same time provides sufficient leverage to grip it firmly by an easy motion of the lever. The operation of adjusting the jaws for different sizes of pipes is very quickly made.

The dies shown on the machine are opened and closed by a lever movement, so that running back over the thread is avoided, and threads may be cut and pipe cut to lengths without removing the dies, or making any change whatever. Solid dies, however, can be used if preferred.

In these machines the gradations of speeds are such that the one suitable may be had for each diameter of pipe within their range.

The machine shown in Fig. 1 has the chuck at the back end, and is more particularly designed for use on sizes not less than 1″ diameter. It will cut from 1″ to 2″ pipe, inclusive.

The one shown in Fig. 2 will cut from ½″ to 2″ pipe, inclusive. This machine has the chuck on the front end, as is found advisable where sizes of pipe smaller than 1″ are to be cut. Both machines are designed from an extensive practical knowledge of the requirements, and are thoroughly and substantially made.

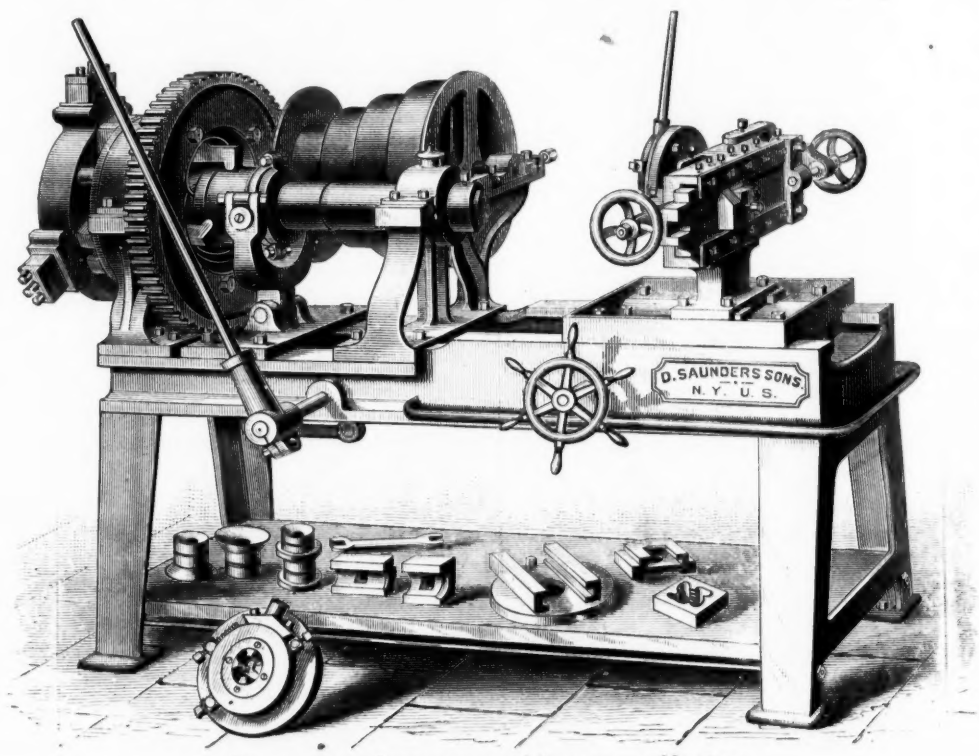


FIG. 1.—PIPE THREADING AND CUTTING-OFF MACHINE.

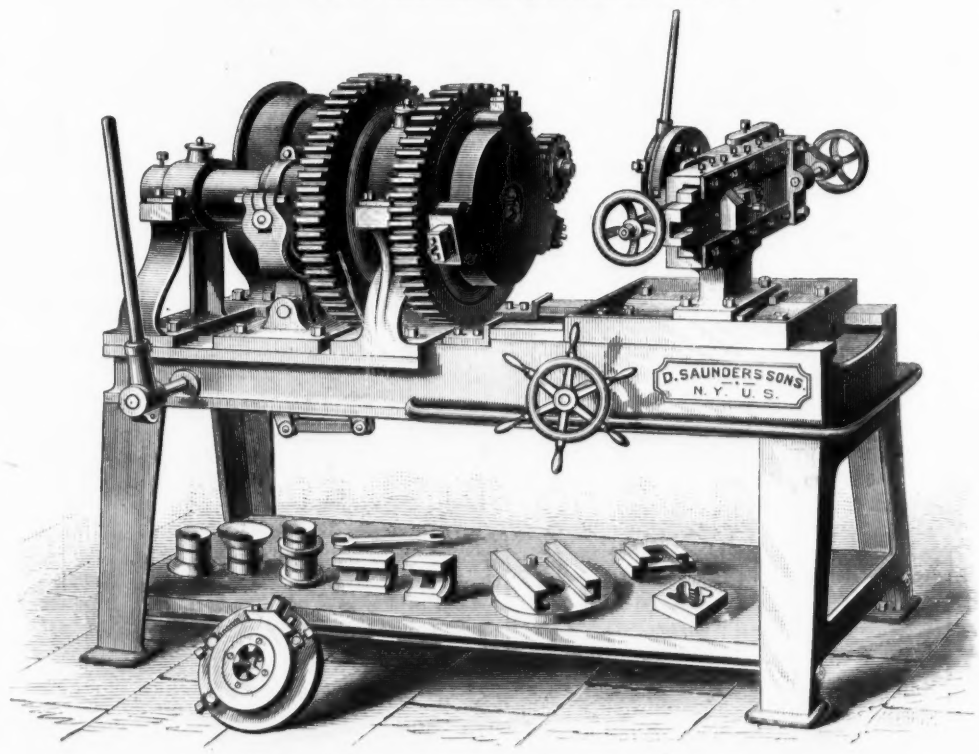


FIG. 2.—PIPE THREADING AND CUTTING-OFF MACHINE.

The civic authorities of American cities do not seem to be very successful in their efforts to compel telegraph and electric lighting companies to put their wires under ground. When companies of this kind are striving to obtain special monopolist privileges from State legislatures there is no limit to the energy and vitality they display; but when they are required to place their wires under ground they suddenly become debilitated—they cannot do it, the difficulties are too great. Where there's a will there's a way, and other nations have shown that the difficulties of conducting telegraph and electric lighting wires under ground are easily overcome. Military considerations made it important that the telegraph wires in France and Germany should be placed under ground, and during the last three years a large percentage of the wires in these countries have been so placed. While the underground wires are more easily kept in repair than were those overhead, an advantage is found in the former that they are not subject to atmospheric disturbances. The wires are laid underground in the form of a cable which is made by a special mechanical process.

It has long been the opinion of many machinists and engineers that a small motor for household service was one of the greatest needs of the time. On the contrary, those who have worked to some extent in this direction, are inclined to the opinion that the demand for such a motor is greatly overestimated. We are still of the opinion that such a motor, if of the right kind, would be appreciated, but just what it should be will only be settled by experiment, and after much disappointment. It is certain that it must be cheap, safe, easily managed, and that the cost of the power furnished must be low—conditions not easily complied with.

The following good story is going the rounds: A useful man to Stonewall Jackson was old Miles, the Virginia bridge builder. The bridges were swept away so often by floods, or burned by the enemy, that Miles was as necessary to the Confederate army as Jackson himself. One day the Union troops had retreated and burned a bridge across the Shenandoah. Jackson, determined to follow them, summoned Miles.

"You must put all your men on that bridge," said he; "they must work all night, and the bridge must be completed by daylight. My engineer shall furnish you with the plan, and you can go right ahead."

Early next morning Jackson, in a very doubtful frame of mind, met the old bridge builder.

"Well," said the General, "did the engineer give you the plan for the bridge?"

"General," returned Miles, slowly, "the bridge is done. I don't know whether the pictur is or not."

The Iron Industry Situation.

"The situation of the iron industries is not very gratifying to manufacturing interests. The downward tendency in iron, steel and coal still continues; supply is in excess of demand. Considerable producing capacity is still idle. Orders for spring and summer requirements come in very slowly. Pennsylvania structural and plate mills are anxiously awaiting the placing of orders for about 12,000 tons of iron, chiefly for bridge purposes, which will be wanted in a short time. The Bessemer steel rail mills have bid on orders for from 50,000 to 75,000 tons of rails, and are waiting the results. The coke syndicate has given out that prices of coke will be advanced May 1st, and the users of coke intimate that they will be obliged to advance the prices of their productions. Mills engaged on specialties are all well employed, but with fewer orders on hand than is usual at this season. Mills on staple products are competing actively for the current trade, and buyers, in consequence, are placing orders very cautiously. The rolling mills are nearly all working to about two-thirds capacity, very few making full time. Confidence is freely expressed in the early improvement of business, but there is no probability of any upward tendency in prices. The nail makers and glass manufacturers, at their recent meetings, reported prospects rather uncertain. More nails and glass will be wanted this year, but the capacity has been so largely increased that there is not enough work to go around; hence, there is a weakening tendency in prices. The cutting of rates on glass, between Eastern and Western manufacturers, has been discontinued. A reduction of wages is threatened in these branches. There is a considerable influx of foreign population into Eastern and Western Pennsylvania coal fields, and, in consequence, a large number of miners have recently left those fields, for the remote Western coal regions. Gas wells have been sunk in several localities in Western Pennsylvania, and in nearly all cases gas in paying quantities has been found. Several new coal openings have struck valuable coal beds in Pennsylvania, and the shipments this year will be larger than ever before, if the market will permit it. A reduction of 10c. per ton in mining has been made in the Clearfield region; and one of 7½c. per ton in Western Pennsylvania, and a like reduction will take

place in West Virginia, and the block coal fields of the West. The demand for Lake ore is inactive. Merchant steel is being bought for pressing requirements only, and agricultural implement works, wagon and carriage works, are only moderately supplied with orders. No general strike is probable in the building trades. A declining tendency is exhibited in steel rails, and large orders are withheld. Imports of iron are falling off, and foreign markets are reported weak. Domestic competition will in all probability result in a still further shading of prices and restriction, rather than to any increase. The policy of consumers is, to purchase as little as possible; hence, demand is irregular, and prices fluctuating. Manufacturers of motive power, machinery and tools, are enjoying more activity than some other branches, but even in these there are well founded complaints of dullness. Some establishments having facilities for making very large and heavy machinery and engines are exceptionally busy, and report prospects excellent for a steady demand during the summer.

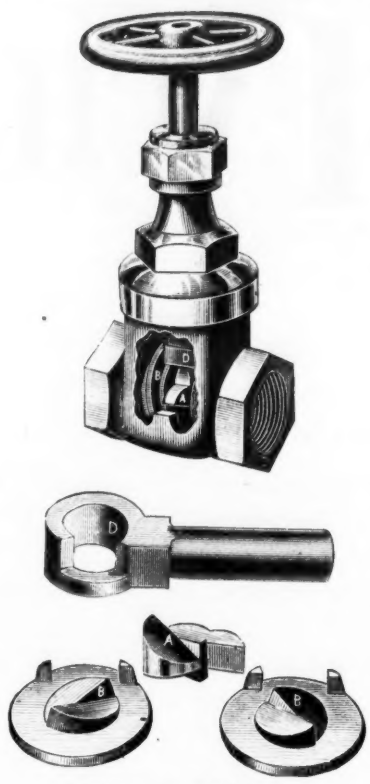
High Speed on the Cincinnati, New Orleans & Texas Pacific Railroad.

As the possibilities in high speeds for long distances with ordinary trains over ordinary roads are being discussed quite freely now, the recent run from Cincinnati to New Orleans of a special train may be of interest. The object was to put a train into New Orleans from Cincinnati in as short a time as possible during the *Mardi Gras* at the latter point, as a competing road proposed to do it in less time. The very best time possible was made, and although for short distances —70 miles in 76 minutes—very high speed was attained, the average for the entire run was, including stops, 37 miles per hour. It may be set down, therefore, that while the present roads, track, etc., are the conditions, an average speed of over 35 miles per hour for long distances cannot be exceeded.

Award of Prizes at the Apprentices' School of the Brooks Locomotive Works.

On the evening of April 3 a goodly audience assembled, at the invitation of Mr. H. G. Brooks at the Apprentices' Night School rooms connected with the Brooks Locomotive Works, Dunkirk, N. Y., to witness the award of prizes to the successful competitors during the past school season. The report of principal Pierce Butler and instructor H. F. Probert showed the school to be prospering. When this was read, Mr. Brooks addressed the pupils on the advantages to be derived from technical knowledge. In the course of his remarks, Mr. Brooks detailed the great disadvantages he was compelled to labor under for want of the educational advantages he was striving to provide for them. This school had excited widespread interest, and he trusted the apprentices would strive to maintain the reputation it had gained during the first season. He had been highly gratified with the work, attendance, interest, and deportment of the scholars, and he hoped that the success which had attended their labors would stimulate them to renewed exertions during the ensuing session. Success is sure to those who make the proper effort, and this success is not measured by the attainment of a money prize alone. Each one who has failed to obtain a money prize may have attained a far more important result in the influence of the work he has done in preparing himself for future development of his well-being. Money prizes were awarded to six of the pupils, and one received a position in the drawing office. Similar prizes will be offered for the work of the coming year.

Many men who are industrious enough about their work, so far as the manual part of it is concerned, are unfortunately the reverse of industrious when it comes to *thinking* about what they are doing. A large part of the difference in the value of different workmen is due to the fact that some men think and work, and others work without thinking.



Seeberger's Disk Valve.

This is a straightway valve, in which the disks are so made and arranged as, when closing the valve, to be forced outwardly and against their seats after they are in position to cover the steam-way, and in opening to be relieved of outward pressure, thus avoiding the evil effects of scraping motion when under heavy pressure. The disks, *B*, are arranged one on either side of the yoke, *D*, the small projections or lugs coming on opposite sides of the square part of the yoke and preventing the disks from turning. These disks are provided on their inner faces with reverse inclined wedge surfaces, which, projecting into the round hole in the yoke, compel them to move with it. Into this hole, between the two disks, the piece, *A*, is fitted; this piece, as will be seen, having wedge-shaped surfaces corresponding with those of the disks. The piece, *A*, is also made with a projecting end, which, when in place, comes in the slot or recess in the yoke, near *D*, in such a way as to permit a definite amount of motion.

It will be readily seen that a circular motion of the piece, *A*, in one direction will, by means of the wedge surfaces, operate to spread the disks apart, and motion in the opposite direction will permit them to approach each other.

The operation is as follows: When the parts are arranged in the case or shell, the yoke, *D*, serves also as a nut for the valve stem, being threaded through the cylindrical end for that purpose. In closing the valve, rotating the stem carries the yoke and the other parts in until the disks are opposite their seats, when the projecting end of piece *A* comes in contact with a stop in the shell. Further motion then tends, in effect, to partially rotate piece *A*. This, in a way that will be readily understood, forces the disks hard against their seats.

Similarly, in opening, the first motion releases the contact of the wedge surfaces, and permits motion of the disks without dragging on their seats. The parts are all interchangeable, and the whole very simple in design and arrangement.

This valve, for which we understand Mr. Seeberger has a patent pending, is manufactured by Holland & Thompson, Troy, N. Y.

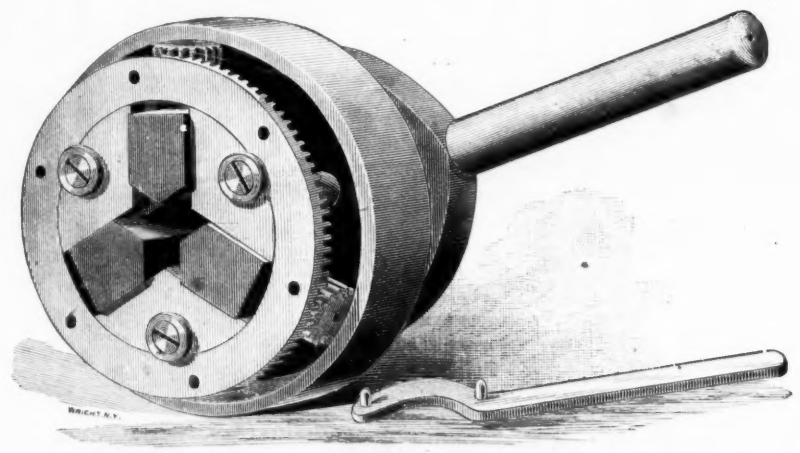
Hard and Soft Cylinders.

The question is frequently asked: Should a cylinder be hard or soft, and should the valve be hard or soft? We found this question answered satisfactorily in the experiments of a prominent master mechanic, extending through a long series of years. He said, "I find if I have a soft cylinder, that a valve of the same degree of hardness always gives trouble, but if I use harder or softer valve than the cylinder no trouble occurs. My practice is to use a soft valve on a hard cylinder, and *vice versa*, and I have formulated my practice by testing the cylinder with a file and then selecting a valve by the same means. Years ago I had the most unaccountable trouble when new valves were put in, and what I have said is the solution of the trouble I had then."

A recent issue of the *Patent Office Gazette* shows a curious attempt to balance the reciprocating parts of locomotives. A heavy counterbalance weight is connected to the crosshead by means of a parallel motion. This motion operates the weight so that it moves in the opposite direction to the piston. We are afraid the work of keeping the parallel motion in order under this arrangement would amount to more than the wear due ordinarily to defective counterbalancing.

Aitchison's New Lathe Chuck.

This chuck is composed of two principal parts. The inside piece holding the jaws and small pinions is connected to lathe spindle without the use of face plate, the thread being cut on the inside. The outer piece or sleeve slides on the inside piece, with taper on the inside of the sleeve resting on the pinions. The forward thrust of the lever by the operator forces the outer sleeve forward, passing over the top of the pinions and forcing the jaws towards the center. The pressure coming direct on the head of the pinions, leaves the gears without strain, and therefore not liable to get out of order. The jaws are inserted with double slots, and the pinions are tapped into the jaws with square thread. One-half turn of the large gear will open the jaws from 0 to $\frac{3}{4}$ inch. With this chuck, as will be inferred, the work is tightened or loosened without stopping the lathe, the large gear and pinions being used only when changing from one size of work to another. It is made by James Aitchison, 108 Canal Street, Cleveland, Ohio.



Aitchison's New Lathe Chuck.

An Electric Headlight.

An electric headlight, the invention of Mr. Woolley, of Indianapolis, has been tried on the Chicago, St. Louis, and Pittsburgh Railroad. It was placed on engine No. 460, which has made several trips, and the result of the test is said to have been very satisfactory. A report says that its reflection is so powerful that a person riding on the engine can see a distance of twenty-three telegraph poles in advance of the engine, and any object upon the track can be observed in time to stop a train running at the rate of forty-five miles per hour before striking it. It is run by a little engine and dynamo placed on the side of the locomotive, back of the Westinghouse air-brake. The engine is, of course, in constant motion, and fed direct from the boiler by an eighth of an inch tap. Its reliability has been the chief anxiety of the inventor. Some weeks ago a method to overcome the effects of the oscillating motion of the locomotive was hit upon, yet there were minor difficulties to overcome which only experimenting would bring out; hence, on two or three of the early trial trips, the light went out. It has now run 5,400 miles, and performed admirably, not once going out. It is claimed for the electric light, that it penetrates through a heavy fog so strongly that an engineer, if any obstacle is on the track, or anything wrong, has ample time to bring his train to a stand-still.

The first cost of the light exceeds that of the ordinary headlight, but the inventor claims that after being once placed on a locomotive, it costs little more to produce light, as the productive power is furnished by a small amount of steam. The inventor states that, while the light is practically perfected, there are minor improvements to be made, which will not only increase its power, but make it as reliable as an ordinary headlight in every respect.—*Railroad Gazette.*

Best Locomotive Piston Packing.

A well-known mechanical engineer says: "The simplifying of cylinder packing is evidently a move in the right direction. To say what is the best cylinder packing appears to be an easy matter, and the same is a solid dead ring with three square grooves in its face into which are sprung three rings $\frac{1}{2}$" square. These rings should be made of new car-wheel iron, cut square across, as the splice joint does not appear to make the piston any tighter. The rings are turned $\frac{3}{8}$ of an inch larger than the cylinder, and many master mechanics then close the rings and bring them to a circle in the lathe, although it does not appear that practically the fit is improved by so doing, as rings without this secondary turning fit to all appearances as well as those returned. With this packing, I have been told, each ring costs but seventeen cents, and they will run on an average of 12 months, with no attention."

In one essential feature the majority of machine shops in this country—perhaps in all countries—are lacking. That is, they are improperly ventilated. One is often struck, upon going from the open air to a busy shop, with a sense of the unhealthy condition of the air, charged with metallic dust which workmen must breathe over and over. Workmen cannot do justice to themselves in such an atmosphere, and it is not only a question of health to them, but as well one of profit to the employer to provide for its systematic removal. From the character of the work done in machine shops, especially where considerable cast iron is worked, good ventilation is very important, and ought to receive more attention.

The Shenandoah Valley Railroad Company have begun the laying of steel rails to replace the iron that has hitherto been used on most of the road. There will be a long stretch of track improved in this way during the coming season. The company regard the present time, when prices of steel are very low, as the best period for making rail renewals. Other companies, whose track needs rail renewals, might save money by following the example of the Shenandoah Valley Railway Company.

Owing to light business, the Burlington, Cedar Rapids and Northern Railway Company have reduced the force of workmen in their repair shops at Cedar Rapids, Iowa, 25 per cent.

The Raoul Journal Box.

A correspondent writes:—"The Raoul stop journal box appears to have a very extended use in the South, its application extending to engine trucks. As this requires an outside bearing with an outside equalizer, with the danger of being displaced by obstructions near the track, it does not appear to be so well adapted as for car journals, although its extended use for engine trucks undoubtedly justifies its use. For car journals it is a splendid thing, as it does not require the turning away of the best part of the journal to obtain a collar, to say nothing of its giving a larger journal, and of showing at a glance the size of the journal. A decided improvement appears to have been made in it by doing away with the wrought iron loops holding the cover in place and substituting a cover sliding in grooves something on the Hewitt style, but without the patented features of the latter."

Southern Railroad Shop Notes.

Frank C. Smith, who has been traveling in the South, sends us the following among other railroad notes:

"To a northern railroad man the most striking feature of southern railroad shops is the remarkable cleanliness of the shop yards and surroundings. At Algiers, La., are located the shops of Morgan's Louisiana and Texas Railroad, in charge of J. D. Connell, master mechanic, who is an old ocean steamship engineer, and has, in addition to the locomotive department, the steamship repairs of the company to keep up. In these shops six laboring men are employed, who have the yard to keep clean in addition to their ordinary duties. Many general managers would argue that the excessive cleanliness is unnecessary and costly; but this is not the case, as Mr. Connell informs me that, as an experiment, he found that if he allowed the yard to become dirty and littered up, he still required the six laboring men for shop duties. The yard is covered with cinders, compactly rolled into a solid surface, and, although cars are constantly repaired in the yard, not a chip or bolt is seen lying around.

"At Whistler, Ala., this feature of cleanliness is supplemented by æsthetic additions of flower beds. M. C. Carson is the master mechanic of the Mobile and Ohio Railroad shops located at this point, and I found in him an old acquaintance, who, when he ran a brass lathe several years ago in a northern railroad shop, we knew as 'Kit,' when I first began knocking my thumb out of place with a chipping hammer. Few public gardens in this country surpass in beauty the one located between the roundhouse and machine shop at this place. The walks are gravel rolled, edged with brick tiling and run in convenient directions, while between them in full bloom are planted in stars, half moons, etc., every imaginable flower, together with the cactus, rubber trees, etc. Mr. Carson also reports that no additional help is required to keep his yard in shape, as the small amount of daily attention can hardly be estimated in dollars and cents. Much of this is undoubtedly due to the climate, in which everything grows spontaneously and without any special cultivation. I was not surprised at this display of taste and beauty on the part of Mr. Carson, as he in his brass-lathe days was noted for the symmetrical hand rail posts, flag staffs, bells, etc., the engines were fitted with.

"Mr. John Flynn, master mechanic of the Western & Atlantic Railroad, Atlanta, Ga., is rebuilding two 18×24 passenger engines. Not having satisfactory boiler shop facilities he bought new boilers of Rogers' people, with the extension smoke-box complete.

"The Wason car shops at Chattanooga have just finished 350 coal dumps for the Cincinnati, New Orleans & Texas Pacific Railroad, which were constructed so satisfactorily that the road has just closed a contract for 500 box cars. The foundations for the new shops of same road at Meridian, Miss., are completed, and the turn table will soon be in place. These shops will do the work for the lower end of the Alabama Great Southern division of the road, the Vicksburg & Meridian division, and the New Orleans & North Eastern divisions.

"The longest trestle work in water in the world is on the New Orleans & North Eastern division of this road. It runs through Lake Pontchartrain, and is 22 miles long in the lake. The sensation of sailing through the water on a train of cars at 30 miles an hour is peculiar.

"New shops are to be erected at Monroe, La., on a new western division the Cincinnati, New Orleans & Texas Pacific Railroad is building. Work will begin on the shops as soon as the Mississippi goes down sufficiently to allow of the excavations being made. This division will run from Vicksburg west to Marshal, Texas.

"Mr. J. H. Wade, master mechanic Richmond & Danville Railroad, is putting the Joy valve gear upon two locomotives at the shops at Richmond, Va.

"During a trip of six weeks through the South, I had no trouble in seeing each issue of your paper, as I found it in most of the master mechanics' offices."

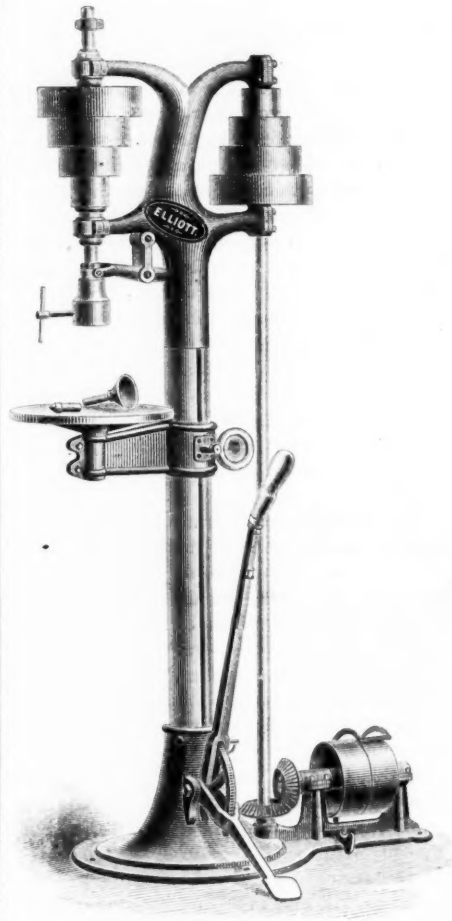


Fig. 1.

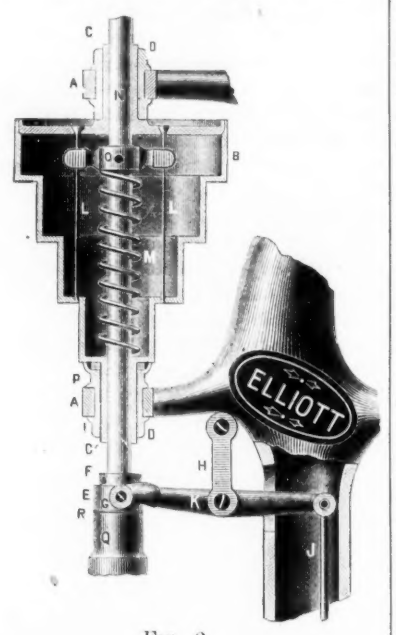


Fig. 2.

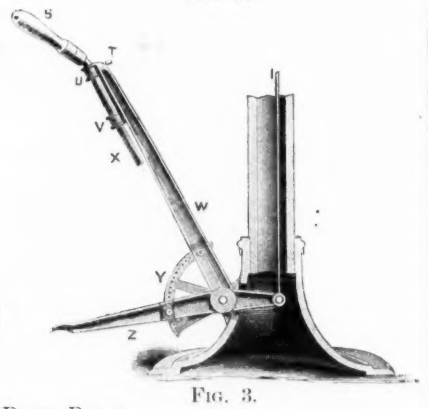


Fig. 3.

Elliott's New Drill Press.

Elliott's New Drill Press.

The engravings shown herewith represent a new drill press, brought out by Sterling Elliott, Newton, Mass. It is intended for drilling holes up to ¾″ diameter, and is very neat in design, and well arranged for rapid work.

The detail cuts, Figs. 2 and 3, represent a section through the driven cone, and an inside view of base and arrangement of feed levers, respectively.

The drill spindle is of steel, 1″ diameter by 21½″ long, driven by cones, the largest and smallest steps of which are 8″ and 3″ diameter. The driven cone is made hollow throughout, and terminates in the sleeves *C*, *C*, Fig. 2, which are 1⅜″ diameter and 2¾″ in length. These sleeves revolve in bronze bearings, the weight of the cone being supported by a rawhide collar in the top of lower bearing, which is made with a flange to form an oil reservoir.

The spindle is free to be moved vertically inside the sleeves *C*, *C*, and is revolved with the cone by means of driver *O*, which slides upon the rods *L*, *L*. The weight of spindle and chuck is counterbalanced by the spiral spring *M*, which also takes up all lost motion. The feeding of the drill may be accomplished either by foot or hand power, or both may, for heavy work, be used together. Either the foot or hand lever may be adjusted by means of the pins through the quadrant *V*, Fig. 3, or either may be disconnected. The height of hand lever, as will be readily seen, may be varied at will to suit the convenience of the operator.

An automatic centering attachment, not shown, provides for centering round or square stock; this attachment being furnished when desired. A drill chuck is furnished with the machine. This drill is thoroughly made, and altogether is a handy and convenient tool.

The Paperware Company, of Syracuse, N. Y., are turning out 10,000 paper buckets a month, the greater part of the operations of manufacture being done by special machinery. Reducing of rags and waste paper to the pulp from which the pails and other articles are made is done by ordinary paper mill machinery; then the material is manipulated by machines arranged to form, finish, dry, and polish the utensils, with scarcely any aid from hand labor. Among the machines is an invention for bending the hoop into shape. After it has been cut to the proper length, the straight strip of iron is run into the machine, from whence it drops a round hoop ready for the top or bottom of the pail. Fastening the hoop to the pail is an automatic operation, and is done accurately and well.

A Mechanical Stoker.

According to the Glasgow *Engineer* a patent mechanical stoker has been introduced into Britain which works very satisfactorily, This Hodgkinson stoker is best adapted for small steam furnaces, and it is said to produce better results than hand firing. The working parts of the machine are few, being simply two revolving shafts with revolving gear. This apparatus sprinkles the coal lightly over the fire the supply being constant. Owing to this arrangement of feeding there is no smoke to complain of, and the combustion is more perfect than where the coal is fired in larger quantities. Little or nothing has been done in this country with mechanical stokers, which is probably due to the fact that comparatively little attention is paid to fuel saving. An arrangement that would feed the coal to a furnace continuously, as it is needed, would probably show better returns in the way of economy than many of our pretentious devices that promise much fuel saving.

Draft-Regulating Appliances of Locomotives.

By J. Dugald Campbell.

FOURTH PAPER.

From the time of the adoption of the exhaust pipe as a promoter of draft by means of exhaust steam, it has, with few exceptions, remained the same. The appliance is so simple that but few means have been tried to improve it; in fact, while it is one of the most important parts of locomotive mechanism, it is one that has received the least attention in its designing or fitting to a locomotive. Where necessity has compelled a change in the manner of doing its work, and consequently in its design, it has shown that it would and will admit of improvement, and that not so much depends upon the velocity of the exhaust steam as upon its volume at the moment of escape from the nozzle, a condition that is affected by the exhaust pipes.

The general reasoning has been that the pipes are simply a means of conducting the exhaust steam from the cylinder to the nozzle, and that the steam, having done its work in the cylinder, anything would do to carry it to its second place of work at the nozzle. The condition which it will be in, or the best condition to have it in to do its second work, when arriving at the nozzle, is seldom considered. When we do so, and also consider the small amount of duty the exhaust steam has to perform, amounting only to about six inches of vacuum, we will be surprised at the exhaust pressure required on most of our locomotives to produce it, and that when special mechanism has been designed for the purpose of getting the best result from the use of exhaust steam, that an exhaust pressure of five pounds will produce two pounds of vacuum, and that the greater the circumference of the exhaust body, the better the result in the vacuum it will produce.

But as the parts of a locomotive that do a certain work must be considered in their adaptability to the locomotive as a whole, appliances that would give the best result in their specific work, may have drawbacks that would unfit them for locomotive or locomotive service (which was the case with the appliance mentioned, although it was in use on a number of locomotives for some time). To these conditions we must conform, and they will govern how far special appliances for any purpose may be used; but if the conditions of the service prevent their adoption, it does not prevent our observing the condition and rules under which they work, and adapting them as far as practicable to the means we have or that may be applicable to a locomotive. By closely observing the effects of differently-arranged draft appliances, we learn that narrow or small pipes compel the use of small exhaust nozzles, by forming the exhaust steam into a long column, and that a chamber placed into or formed by the exhaust pipes as near the exhaust nozzle as possible, allows the exhaust steam to rearrange itself into a broad body that will fill the passages and allow the use of a large exhaust nozzle, and after leaving it by having a large area in contact with gases, etc., in the smoke-box increase its efficiency.

The fact that those with the least knowledge of a mechanical device are usually the ones that see, in their own minds, just how it can be improved, find constant expression in applications for favor in the Patent Office, as well as in many other ways. If from the list of patents granted those were deducted that are granted to those who know nothing about the subject except in the most general way, the proportion of successful or useful patents to those that are the reverse would be materially increased. There is nothing remarkable in this, as in mechanical matters to know what won't work satisfactorily is much the hardest lesson to learn, and judgment in this respect usually comes from years of practice in specific directions. Notwithstanding this, those with the greatest amount of experience are seldom the ones who talk most about reform.

LETTERS FROM PRACTICAL MEN.

Making Copper Castings.

Editor American Machinist:

In your issue of October 20, 1883, a correspondent asks how to make sound copper castings. I submit the following for his consideration: Charge the crucible with the copper to be melted, and cover the copper with a layer of bone powder two inches thick. The bone powder may be calcined, the same as used for case hardening. When the copper is melted, remove the crucible cover and bone ash from the surface of the molten copper, and stir the copper well with a stick before filling the moulds.

By the above process, fluid metal and sharp sound castings may be produced.

J. R. FORSYTH, Lieut.,
Gun carriage factory, Madras, India.

A Paint Shop Kink.

Editor American Machinist:

The glass in the monitor deck sash of our coaches has a frosted surface, with a transparent design cut in. Wishing to replace some which were broken, and having none of the patterns on hand, I conceived the idea of reproducing it on plain frosted glass. This was done by merely painting the design with clear varnish on the frosted side. This brings out the figure clear and transparent, and at a few feet distant the imitation cannot be distinguished from the original.

D. J. JUSTICE,
General foreman, Florida Southern Railway Shops.

Palatka, Fla.

Water Glass Cock with Ball Valve Used Fifteen Years Ago.

Editor American Machinist:

In your issue No. 11, you describe a water tube glass gage, with an automatic closing ball valve, and credit John Player, of the New York, West Shore and Buffalo Railroad, as the inventor. In your issue of April 5th, Mr. George H. Crosby claims that he invented and patented this same device several years ago, which is owned by the Crosby Steam Gage and Valve Company, of Boston. In your issue of April 12th, Mr. Anthony Victorin, of Chicago, states that this device was in use for a short time on engines (boilers) of Austrian railways in 1871.

I myself bought and sold automatic closing ball valves in connection with water glass gages, as shown and described, over *fifteen years* ago. The maker and inventor's name I cannot at present recall, but they were made in the Singer Manufacturing Company's Delancy Street building, about 1867. Thomas Bennett, who was the engineer at that time, no doubt, if living, could give his name.

W. BARNET LEVAN,
Philadelphia. 3607 Baring Street.

Centrifugal Force.

Editor American Machinist:

I have been quite interested in the articles in your columns in regard to "Centrifugal Force," and wish to add my mite to the discussion in support of the position of Mr. Chas. T. Porter.

More than thirty years ago I had an argument with Capt. Chas. H. Bigelow, then chief engineer of the Essex Company, of this city, in which I took substantially the same ground as that now taken by Mr. Porter, viz., that there is no such thing as centrifugal force, pure and simple, and that what went by that name was simply *vis inertia*.

Taking another view of the matter, it may be stated as the sum of continually-applied tangential forces, minus the restraining force of the strength of material, as in the case of a pulley, grindstone, or other revolving body.

I then held, as I understand Mr. Porter to hold now, that when the restraint is removed, or when the pulley or grindstone breaks, the pieces will fly off in the direction of the last applied tangential force, and not radially, from the center. I may be mistaken, but do not think I am.

When a pulley or stone, three or four feet in diameter, bursts from its own weakness, it would be a pretty difficult thing for an observer to decide, at a distance of forty feet, whether the line of propulsion of the fragments was tangential from the circumference, or radial from the center, as seen in the accompanying sketch:

I have no question myself that it will be in the line of the last communicated motion.

Mr. Porter uses so entirely the line of argument which I have formerly employed that it is not necessary for me to say more, except that I fully agree with him.

Lawrence, Mass. SAML. WEBBER.

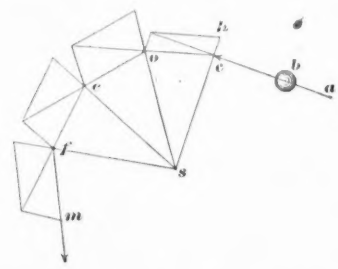
Centrifugal Force a Component of Tangential Tendency.

Editor American Machinist:

Mr. Porter's letter of March 26th still leaves me under the necessity of maintaining the validity of my defense.

I do not admit the correctness of Mr. Porter's distinction between the *string*, as *acting*, and the *apple*, as *resisting*. On the contrary, as pointed out in my former letter, we are equally correct in regarding the *apple* as *acting*, by its centrifugal force, to stretch the string out to the tangent, and the *string* as *resisting* this pull. Indeed, as the string has *no motion* toward the center, it would be more properly represented, in my sketch, by *stationary* cues, or plane surfaces. at *o*, *e*, and *f*, so that if any such distinction were made, it should rather be that the *ball*, or apple, *acted* (centrifugally), and that the *cue*, or string, *resisted* (centripetally).

As Mr. Porter repeats that "the body does not have a tendency to fly from the center, but from the circumference—not to move in a radial line, but in a tangent;" I am forced to repeat, also, that at each point



e, *o*, *e*, *f*, in the sketch, and at *every instant* in the case of the apple and string, this "tangential tendency becomes *decomposed* into (1st.) a new tangential tendency *c*, *o*, *and* (2nd.) *a tendency*, *c*, *h*, *'to fly off in a radius'*", and that thus "the centrifugal force is a *component* of the tangential tendency."

Mr. Porter says truly that "the term 'centrifugal' has a tendency to convey an entirely wrong impression of" the *tangential* action. It might, with equal truth, be said that it conveys a wrong impression of the pull of a horse. The term is *not applied* either to the pull of a horse or to the tangential tendency of a revolving body. It is applied only to a *component* of the tangential tendency, to the "tendency to fly off in a radius," which is the same thing as its "resistance to deflection from a tangent;" and I think I have shown, with Mr. Porter's assistance, that the term in question is a most appropriate one for this force, and that so far from tending to give a wrong impression, or to create confusion, it tends to *prevent* confusion by making clear the distinction between the obvious tangential tendency and its equally real centrifugal component.

JOHN C. TRAUTWINE, JR.
Philadelphia, April 3, 1884.

Credit for a Formula.

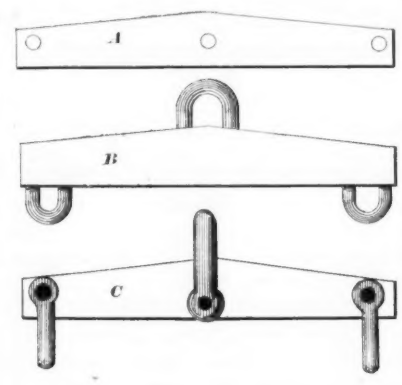
Editor American Machinist:

In the AMERICAN MACHINIST of April 12 appears a communication bearing my name, relative to counterbalancing locomotive driving wheels. In an editorial I am also given credit for working out the problem. This is a mistake. The formula was furnished us, as I suppose it was to all other shops of the P. R. R., for our information and guidance. I furnished a friend with a copy, not dreaming of its publication, which has caused me much annoyance. A. DOLBEER.

That Evener Question.

Editor American Machinist:

In answer to Question 144, it depends on the kind of evener whether the horse that is ahead or the one that is behind pulls the most



of the load. If like that shown at *A*, there will be no difference; if like *B*, it is bad for the horse that is ahead; if like *C*, the horse that is behind has the worst of it. J. E. S.

The Equidistant Series of Gear Cutters.

Editor American Machinist:

Professor McCord devotes a great amount of space to the proof that my formula is not "absolutely precise," as he expresses it. It was never claimed to be, and he has simply proved the truth of my statement that it is a very close approximation. I could not have done it better myself, and am duly grateful.

The fact, if it is a fact, that the locus methods uniformly distribute the errors in velocity ratio, was not mentioned by the professor until I pointed out that it was the principal object in view. He may have known it, but the fact stands that in the eight pages of his treatise devoted to this subject he never mentions it even indirectly. He has not yet proved that it is a truism, or that it exists at all.

The locus curve is transcendental, and it is quite impracticable to deviate it in its true course; but if the chords, from point to point of the series, are uniform, the series will be as nearly uniform as is practicable.

Given any two teeth, we can compute by a laborious trigonometrical process the coordinates of the corresponding points of the curve, and from these find the chord between the points.

If this be done carefully, it will be found that no series yet given will deviate the locus curve uniformly to a single tooth, or, indeed, within several teeth in the upper part of the series. An examination of the two columns, III. and IV. shows that my series, III., is the most nearly uniform of the two.

To fair and honest criticism I make no objection, and I do not object to the locus method because it contradicts my own. But I do object to the summary and unfair treatment of my humble effort in McCord's treatise. He magnifies its defects, and, carelessly or carefully, conceals its real merit. He tumbles it out with the sneering admission that it will give "tolerably close approximation" under some conditions, and puts in its place what he claims to be a "perfect solution of the problem," which is accurate to a single tooth, but which is really, if we are to judge by its work, no improvement whatever on the method it was intended to displace.

If he claims first place on account of perfection, it is certainly proper for me to show that nothing resembling perfection has been reached. Professors who live in glass houses should never throw stones.

As for that target, I think it would make small odds where the bull's eye was placed, if no one could hit it nearer than the professor has hit the perfect solution he has been shooting at.

It is no use trying to dodge the figures. The three-thousandth of an inch on a tooth of four pitch is an "imperceptible fraction." If the tooth was large enough—as large as a man's fist—the error, if it is an error, might be perceptible, but I have been dealing with the subject as it is, not as it can be made by stretching. GEO. B. GRANT.

Boston.

An Apprentice Wanted.

Editor American Machinist:

We want a young man to learn the trade in our machine shop, and I understood you to say in an editorial some months ago, you would use your influence in behalf of young men of merit who wanted such situations. Our shop is a respectable small shop, doing a business in coal-hoisting engines, and other kinds of moderate dimensions (up to 28×36 cyl.), some stamping, and a great variety of jobbing and repair work. We employ from 15 to 30 men.

Will pay a suitable young man of 18, say four dollars per week to begin, and increase from time to time to seven dollars, in a term of three years. He must be steady, industrious, and have a good common school education, and not sickly. Will give one who is capable of being pushed—that is advanced rapidly—a good chance to learn everything in the shop, including drawing, but on the other hand we will expect the party to merit his promotion before he gets it. If you have such a person in your mind, we will trust you to make a choice for us. We would be pleased to refer to several boys who have graduated with us creditably.

C. W. CRAWFORD,
for Crawford & M'Crimmon.

Brazil, Ind.

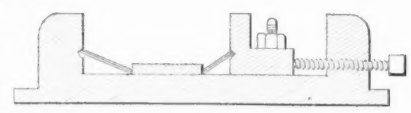
[We publish the above in order to give the boys a chance to apply, and the firm a good chance to select.]

Planer Chuck for Thin Work.

Editor American Machinist:

I have seldom found a planer hand, or machinist who could plane a piece of metal, say a foot long and an inch wide, down to $\frac{1}{16}$" thick, without a great deal of trouble.

Now, for all such work, I have found a chuck, or "shoe," the best tool for holding the piece, and I fix it like the inclosed sketch.



What pleased me in Mr. Johnson's article was: "I wish the subject of accurate measurements might be sufficiently agitated," etc. I am an admirer of accurate work, but I have yet to learn the "importance of $\frac{1}{1000}$ of an inch." I have worked in a shop where they made $\frac{1}{1000}$ of an inch and the tools to measure it with, and I know what I am talking about when I say it is all wind.

I know (by the shipping clerk) that while I worked there they sold twelve micrometer calipers to one concern, and ten of them came back because they could not be made to measure alike.

I have a three-inch U. S. standard scale that, when tested by a square at the first inch line, the blade will completely cover the line on one edge, and show the whole line on the other edge.

What is the use of talking of accurate measurements when we cannot get accurate tools to measure with? If any concern wants good, close work, let that concern employ a good tool-maker to make hardened steel gauges, and require the workmen to work to them, and not ask a man to measure a thousandth of an inch with a two-foot rule, or its next-door neighbor, a U. S. standard scale.

All the way we can measure $\frac{1}{1000}$ of an inch is by a micrometer or vernier, and when we get one set it is simply a gauge—if perfect, all right; if not, all wrong.

I am now employed in a shop with from 700 to 800 hands. I had a casting given me a few days since with drawing on which was a call for 15.5835+".

I asked for a vernier, and was told there was not one about the works. "Guess at it as near as you can." When I come to look the drawing over, I found one end of the line started from the rough casting. It looked well on paper, and is a nice thing to talk about—*five thousand eight hundred and thirty-five ten thousandths of an inch!*

Will some one tell me the advantage of "accurate measurements" without tools to depend on? M. C. K.

Geometry Applied to Pattern Making.

BY ISAAC WHITEHEAD.

To apply science to art and manufacture is the only way by which it can be made of any service. The principles of geometry, as taught by our scientists, are not applicable to the different trades, each requiring the solution of a certain class of problems under peculiar conditions. It becomes necessary, therefore, that the work of adapting a science to the workshop must be done by the mechanics themselves, and that each should study the principles as far as they apply to his business, and apply them so that they will become a part of his trade. Mr. West, in an able paper entitled "Geometry in the Foundry," contributed to the AMERICAN MACHINIST of December 15, 1883, made a good move in this direction, suiting geometry to the requirements and conditions of the foundry.

THE LAW GOVERNING WORKING DRAWINGS.

Patterns are made mostly from drawings which give at least two of the three views, namely: Horizontal (or plan), which views from the top of the object; and the two vertical views (or elevations,) which take a front or end view. Each view is shown at right angles to the other, and is turned upon an imaginary vertical or horizontal line in the direction in which it is shown. For instance, a view which shows the object turned one-quarter round toward the right, must be placed on the right side of the view from which it is taken, and so on for each direction. I have seen mistakes occur, the pattern being made wrong-handed through not observing this rule in the drawing.

The foundation of all mechanical form is the circle and square.

DIVISIBLE PROPERTIES OF A CIRCLE.

A circle is divided into 360 degrees. The radius of a circle will space upon its circumference six times equally, and therefore each space will equal 60°. Now, since the radius chord (or 60°) is so easily obtained, let us use this as a standard upon which all other divisions shall be made, by finding its relation to the number of spacings or divisions required. It is evident that in the case of 7 divisions of a circle—for instance, $\frac{1}{7}$ of the circle $=\frac{6}{7}$ of $\frac{1}{6}$ of the circle, and that all other divisions stand in the same relation, therefore upon the basis of the arc of 60° as the standard of measurement, we have the following result: $\frac{1}{3}$ of a circle $=\frac{6}{3}$ of the arc, $\frac{1}{4}=\frac{6}{4}$, $\frac{1}{5}=\frac{6}{5}$, $\frac{1}{6}=\frac{6}{6}$, $\frac{1}{7}=\frac{6}{7}$, $\frac{1}{8}=\frac{6}{8}$, $\frac{1}{9}=\frac{6}{9}$, $\frac{1}{11}=\frac{6}{11}$, $\frac{1}{15}=\frac{6}{15}$, and so on in divisions to any number. When desirable, smaller dividing ratios might be used; for instance, 10 degrees. Then if we wanted $\frac{1}{48}$ of a circle it $=\frac{6}{48}=\frac{3}{4}$ of 10°, or $\frac{6}{48}$ or $\frac{1}{8}$ of 60°. This rule is so very useful, so easily remembered, and yet so little known among pattern makers, apparently, that I have dwelt at greater length upon it here.

It can be applied to great advantage on segments of patterns and core boxes, and for laying out circular and angular work generally, especially large work, where it would not be convenient or practical to lay off the whole circle, and it will be found more accurate, because of the finer spacing possible, than on a large area.

FOR SPACING GEARS.

For spacing the circumference into small divisions, as in the case of the pitch of gears, mathematics based upon the same geometrical principle of degrees are used to obtain the true or chordal pitch. For instance: To compute the true pitch, first divide 180° by the number of teeth, ascertain the sine of the quotient and multiply by the diameter of the wheel. Take, for example, a gear 2″ in diameter, with 6 teeth, $\frac{180}{6}=30°$, and sine of 30°=.5, which, multiplied by 2=1″ pitch.

The sine of an arc is the perpendicular let fall from one extremity of the arc, on the radius, passing through the other extremity. Thus *B C* is the sine of the arc *A B*. It is thus evident that a sine is half the chord of the number of degrees contained in the arc of the circle between the pitch points, and, therefore, the principle is the same as in the first rule for divisions.

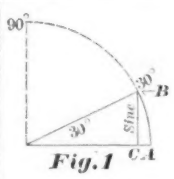


Fig. 1

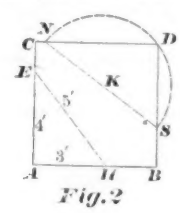


Fig. 2

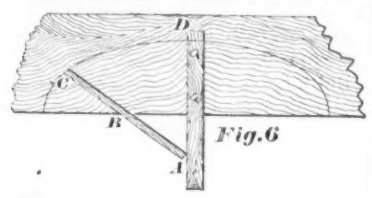


Fig. 6

TO TEST OR LAY OFF A SQUARE.

The method of most universal application is by applying the proportions of 3, 4, and 5 to the sides of the right angle. For instance: upon the line *A B*, Fig. 2, measure off 3-ft. to a point *H*. From *A* as a center describe an arc 4 ft., and from *H* as a center cut the arc at *E*. Produce the line *E A*, which will be square or perpendicular to *A B*. Instead of feet any other units of measurements, or numbers having the same proportions, as is most convenient in each case, may be used.

Another useful test, which is more generally known, is to take any radius, *K D*, and from the point *K*, describe an arc through the point *D* cutting the given line *D C* at *N*. Produce a straight line from *N* through the center *K*, intersecting the arc at *S*, and the line *S D* will be square to *D C*.

There are many other properties of the circle and square which are very useful to a pattern maker, but which are presented in practical shape in works on geometry, and therefore it will not be necessary for me to mention them in this connection.

TO DESCRIBE A CIRCLE THROUGH THREE POINTS, A, B, AND C, FIG. 3.

With any convenient radius bisect the points *A B* and *B C* by intersecting arcs, as shown. Produce lines through the intersections, and their intersection at *D* will be the center required. To find the center of a circle to complete the circle whose center is lost, or to describe a circle round a triangle, may be solved the same way.

Fig. 3

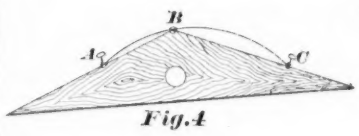


Fig. 4

Fig. 5

When the circle is so large that the center cannot be used conveniently, a template of wood or cardboard may be used, as shown in Fig. 4. Let *A*, *B* and *C* be the three points. Draw a line from *B*, through *A*, the length of *A C*, as one edge of the template, and from *B*, through *C* the same length as the other edge. By placing a pin in the point *A*, and one in *C*, and sliding the face of the template upon them, a pencil point at *B* on the template will describe the true arc of the circle.

TO DESCRIBE AN ELLIPSE.

A simple and practical way to describe elliptic curves on wood of any size, is: Take a strip of wood, and step off *A B*, Fig. 5, equal to half the minor axis, and *A C* equal to the major axis, and cut off the stick at *A* and *C*. Tack a light straight-edge on the board at *D*, Fig. 6, square to the edge of the board and slide the end *C*, and edge *B*, of the strip within the square formed by the edge of board and straight-edge, and with a pencil at the end *C*, of the strip, one-quarter of the ellipse will be described. Reverse the thin straight-edge on the line *A B* to face the other half, and you can describe the other quarter. When desired, the whole ellipse can be struck on the center of a board by using two thin straight-edges, or a common carpenter's square, and the same strip of wood. To draw it upon paper, use a narrow strip of paper instead of wood. Mark off *A*, *B* and *C* upon its edges, and while *A* and *B* are laid upon the lines of axis mark off points at *C*.

TO LAY OFF CYLINDER OR PIPE CONNECTIONS.

To lay off the outline of connection upon the outer surface of a pipe is of great advantage in the production of good and cheap work, compared to the guessing, cutting and trying method adopted by many workmen. After using it once or twice it becomes very simple, and is easily remembered. When two cylinders of the same diameter join at right angles to each other, then the joint will form a mitre, or the angle of 45° to the center, as appears in Fig. 8. If the pattern is in halves, lay off the angle and saw it out square with the pattern joint, so that when the two halves are put together the face will appear as in Fig. 9. The outline of the flat surface will be the outline of connection, and therefore by sawing and paring it through down to that line the cylinder will then fit perfectly. When cylinders of the same diameter join at an angle, as the lower connection of Fig. 11, the line of connection will be shown by a line drawn across from the corners of connection—*A* to *A*, and *B* to *B*, Fig. 11, which will be the angles required. First cut the face in the step taken for Fig. 9, and then cut to the outline of angular face, as before.

Figs. 10 and 11 show a small cylinder connecting with a larger one, the branches on one side joining its center, and the other below.

Describe the half circle *x R x* on the same center as the branch, and space it off into convenient equal spaces on its circumference, as 7, 8, 1, 2 and 3. From these points draw parallel lines with center of branch until they intersect the cylinder connection. On the circumference of the turned branch pipe, lay off corresponding divisions and parallel lines. Transfer from the straight line *X X*, the length of the lines *X 3′*, *X 2′*, etc. (being the length of those points up to the cylinder connection), upon the lines on the branch pattern. Connect the points by easy curves, which will be the line of connection when the branch joins at right angles, as at *P*, Fig. 11.

The lower branch of Fig. 11 shows an angular connection which on the right hand is connected below the center, and on the left joins on the same center. To show the principle clearer, I have shown the whole end of the branch pipe, divided into eight equal parts. Produce from these points lines parallel with the branch until they intersect with the body of the cylinder, as will be shown by dropping the corresponding intersections from elevation, Fig. 4, upon them, as shown.

It is sometimes handier (and cheaper, when there is more than one connection) to lay out a development of the joint upon stiff paper, as shown by Fig. 12, which is done as follows: On the line *A B*, space off eight spaces equal to the spacing on end of branch. Erect perpendiculars and mark them with numbers corresponding to branch. Transfer the length of lines on branch to the corresponding line of development, Fig. 12, 5 to 5 equals length of No. 5 line, 6 to 6, and so on with each line, then join the intersections. By cutting the paper through these intersections, and applying it on the branch, the outline of connection may be marked out and the end of branch formed to it, knowing it will stand exactly right when it is done.

By making a correct plan and elevation the pipe can be shown to connect to any definite surface, and at any conceivable angle, and the outline of connection can be determined by the same steps as in this case.

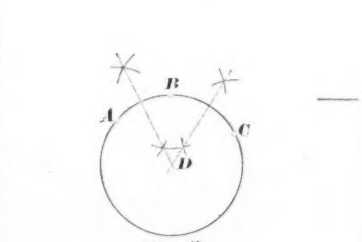


Fig. 7

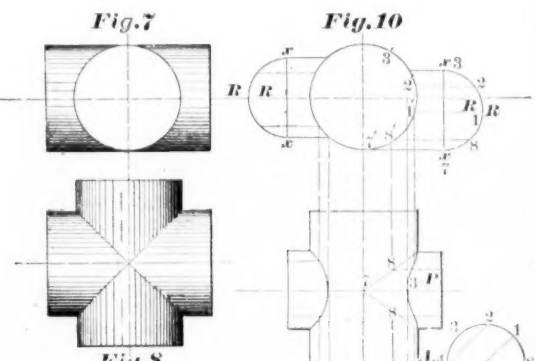


Fig. 10

Fig. 8

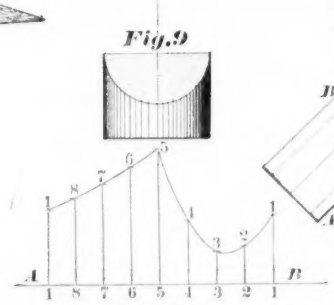


Fig. 9

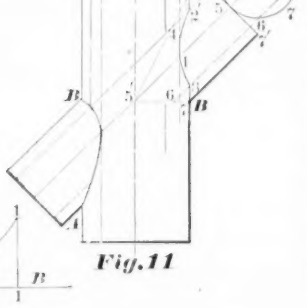


Fig. 11

Fig. 12

Trouble with an Extended Smoke-Box.

On one of our leading railroads a locomotive was rebuilt and fitted with the extension smoke-box, which was an experiment for that road, and consequently was looked upon with some degree of distrust. When the engine was put on the road, it was found that she did not steam satisfactorily. Of course, it was at once concluded that the draft arrangements were to blame, and experiments were made with the view of adjusting the flow of gases through the tubes to produce better results. The traveling engineer of the road had charge of the job, and he proceeded industriously to work at locating the trouble. He tried everything in the way of adjusting the smoke-box attachments that could be thought of, but nothing that was done improved the steaming qualities of the engine. He then proceeded to search for trouble in some other direction. The result of his examination was the discovery that the engine was working with three-fourth inch clearance at each end of cylinders. This, he naturally concluded, entailed a serious waste of steam; so he had the clearance reduced to one-fourth inch. When the engine got out after this change, she steamed very satisfactorily, and the extension smoke-box is no longer in disrepute on that road.

Black lead rubbed on the surface of cast iron is useful in preventing rust.

Burlington, Cedar Rapids and Northern Railway.

By a private letter from Mr. Ives, general manager of the Burlington, Cedar Rapids and Northern Railway, we learn that extensions, amounting to 265 miles of new road, will be built this year. The North-western extension will reach as far as Watertown, Dakota. From a more recent source we learn that the company has decided to increase the capital stock to $30,000,000, in order that all bonds of the various divisions may be supplanted by one general form of bond, and to provide for the expenses of extension. At the meeting where this decision was arrived at Mr. Ives was elected vice-president. This gentleman, who is coming to the front among railroad magnates, is an entirely self-made man, having by his own energy, perseverance and ability risen step by step from the lowest rounds of the railroad ladder.

Dynamite Gun.

Since the introduction of dynamite and other nitro-glycerine compounds for explosive purposes, numerous attempts have been made to apply their destructive force to war operations. Unless in the case of torpedoes all attempts in this direction have proved futile, principally for want of a moderately safe gun to throw a projectile containing dynamite. Common ordnance is inapplicable for firing a dynamite-charged shell, as the shock bursts the explosive prematurely, and is apt to do more damage to friends than to enemies. A gun which is being tested by the United States Government promises to throw successfully projectiles charged with dynamite. The propelling force used is compressed air, and the gun is constructed specially for that means of applying force to ordnance. The gun consists of a long steel tube with all the fittings necessary to admit air compressed to the neighborhood of 500 pounds to the square inch. A new gun is in course of construction in New York to which air of 2,000 pressure can be applied.

The Indicator Diagram.

By F. F. Hemenway.

PECULIARITIES OF DIAGRAMS.

The diagram, Fig. 16, is handed me with a request for an explanation of why the line from *a* to *b* (drawn after the cut-off valve has closed) is substantially straight, and nearly vertical in direction. As this is frequently found to be the case, and, as in this instance, is sometimes believed to indicate something wrong in the operation of the indicator, the real cause is worth investigating. First, what is here believed to be phenomenal is only observed in instances where the cut-off is short *and sharp*, and where the clearance is small. In such instances the pressure in the cylinder falls very rapidly, directly after cut-off, because a small movement of the piston will serve to increase, largely, the *volume* of steam in the cylinder as compared with the volume at cut-off, and correspondingly decreases the pressure. In the cylinder from which this diagram was taken, the clearance marked on the diagram is .0253 of the displacement of the piston, and the cut-off is at about $\frac{1}{15}$ of the stroke. The steam being cut off with the suddenness of a blow, at *a*, the piston traveling at a mean speed of between 500 and 600 feet per minute, and the distance, horizontally, from *a* to *b* representing less than one inch motion of the piston, it will be seen that the pressure under the indicator piston is almost *instantly* very materially reduced. The spring being under considerable tension starts the piston down, and the momentum which it soon acquires carries the pencil ahead of the position due to the steam pressure, precisely as in diagrams from high-speed engines, or in those taken with a light spring, the pencil is found alternately too low and too high, the result being, a little later in the stroke, a regularly undulating line that is correctly taken as evidence of correct action of the indicator. In these instances the pencil will fall below its correct position, then the reaction will carry it above, and so on. In this instance the first evidence of reaction is at *b*, which is where the reciprocating parts of the indicator recover from the effects of their downward impetus. Had this occurred later the pencil would have been carried up considerably out of its true course, but at this early point in the stroke the pressure is falling too rapidly for this to occur, so that the reaction amounts to scarcely more than a pause in the downward motion. Below *b*, a short distance, there is another pause, after which the expansion line gets into proper shape, being assisted by the more gradual fall in pressure as the volume of steam is increased. As previously noted, had precisely the same thing occurred later in the stroke, as from a cut-off when the volume of steam in the cylinder was twice or three times as great, the result would have been the wavy expansion line frequently seen.

But there is still another cause that tends to produce a straight line from *a* to *b*. As has been explained in a previous paper, the actual curve of the diagram is usually found below the theoretical curve directly after cut-off, especially where full steam is worked for a small fraction of the stroke only, from the fact that condensation is taking place to supply the heat lost during expansion and exhaust; so that taking into consideration both these causes, each operating in the same direction, the position of the line from *a* to *b* is logically accounted for without attributing any fault to the indicator, which so far as can be seen from the diagram, was in good working condition. Finally, drawing the theoretical curve from the point of cut-off the variation is not nearly so great as a glance at the diagram would seem to indicate. A part of this curve is drawn, in dotted line, and shows the variation a little greater than it actually is.

Diagram 17 shows peculiarities that cannot be explained in this way. The initial pressure was 60 lbs.—one pound less than boiler pressure—and the valve closed very sharply at *c*, after the piston had made a small fraction, about five per cent., of its stroke. The effort to recover after the usual somewhat too rapid fall of the pencil is seen at *d*, and from some cause the pressure rises again to nearly 60 lbs., making, apparently, two points, *c*, *c'*, of cut-off. The cause of this was that the cut-off valve, which dropped in closing, afterward left its seat, and from the amplitude of the steam ports actually admitted steam of nearly boiler pressure the second time. From a short distance below *c'* the line falls too slowly for some distance, showing that the valve leaked while settling back against its seat. The engine from which this diagram was taken was a small one, and the aggregate length of the ports controlled by the cut-off valve was equal to about twice the diameter of the cylinder. With this length of port the cut-off proper occurred while the valve was dropping at its highest velocity, and through only a very short distance. The effect of this was that the pressure in the cylinder was not reduced enough while the valve was closing, so that the unbalanced pressure in the steam chest would hold the valve to its seat against the jar of the air cushion which stopped it.

There were two remedies that suggested themselves, one of which was to provide for closing the valve slower, and the other to arrange a guard to prevent the valve leaving the seat, horizontally. The last remedy was the one tried, with perfect success.

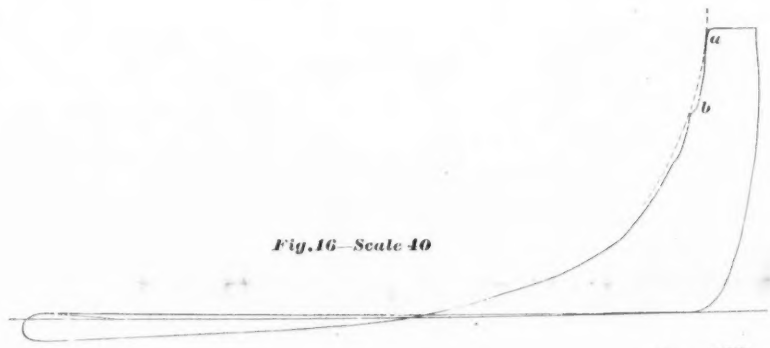


Fig. 16—Scale 40

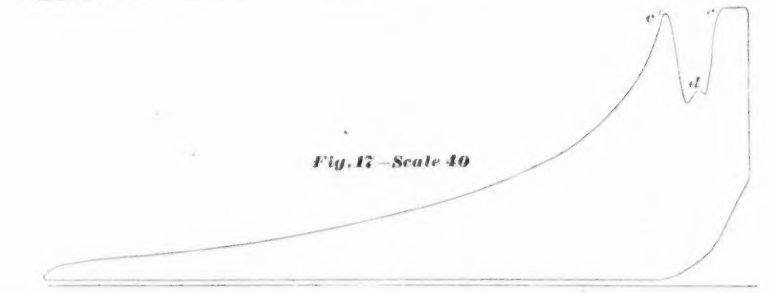


Fig. 17—Scale 40

While other nations lacked the skilled workmen and raw material to compete in manufacturing enterprises, free trade was an unqualified good for Britain; but circumstances have changed seriously of late years, and now the people of that country are beginning to find that free trade has its drawbacks. Ten years ago, Britain was the iron ship-building yard for the world, all civilized nations getting vessels built there. Some of the largest ironclads belonging to Germany were built in Britain; and France, Italy, and other European nations that have ironclads over ten years old, got them built in English or Scotch yards. To-day hundreds of ship builders and machinists are idle, and business is very depressed in the building yards of the Tyne and Clyde. But Germany and Belgium and France are coming to the front as builders of iron ships. Ship yards in the North Sea and the Baltic belonging to continental nations are busy building ships for Spain, Italy, and China, the contracts for the vessels being awarded away from British yards because the work was done cheaper elsewhere. Meanwhile, the advocates of free trade inform the unemployed workmen of England and Scotland that when they are ready to work for the low wages current in Germany and Belgium, British shipbuilding will revive. A curious point about the teaching of these free traders is that they gravely assure American workmen that free trade would reduce their expenses without materially reducing their wages. Few intelligent workmen on this side of the Atlantic care to try the experiment.

Boiler Plate Stamps—Laminated Plates—Steel Plates.

By George Marshall.

The purchaser of a boiler is sometimes considerably puzzled to get at a perfect understanding of the meaning of trade names for the different qualities of iron, made by the different makers of boiler plates. He will be informed by one party that the iron used by him is "the best," when it frequently occurs that not a pound of "best" iron has been in the shop for years. Another party will probably be a little more definite, and say the boiler is or should be built of the best "C. H. No. 1 iron." This term, conveying no real idea to the uninitiated, is far from satisfactory; but as he has so far advanced in the matter, he thinks further progress perhaps will bring a solution of the mystery. In another shop he will perhaps be informed that the fire-box plates are made of "fire-box" iron, the balance being of shell quality; but this actually conveys no new knowledge.

The different qualities of iron used in the manufacture of steam boilers at the present time are "refined," "shell," "C. H. No. 1 flange," "C. H. No. 1 flange fire-box;" and where an extra quality of iron is required for fire-boxes or for the manipulation of flanges of difficult form, a guarantee iron (for which there is no uniform name, a mills giving to this grade the name most pleasing to themselves,) is furnished by the mill, the conditions of sale being "the replacing of any plate proving defective, and the payment by the mill owner of the labor bill of the manufacturer up to the time of the defect becoming manifest."

Now, the real facts in regard to the merits of the different brands of iron as given above should be known to the general public, that they may thoroughly understand the quality of the material they pay for and prevent deception on the part of the manufacturer, who, perhaps from close competition, or inherent dishonesty, is sometimes tempted to alter the quality of material supposed to be used from one grade to another. "C. H. No. 1 flange" and "C. H. No. 1 fire-box" are really charcoal iron; "shell" iron has an outer skin of charcoal iron, while "refined" has no charcoal iron, but is simply refined "pig." The latter brand being the cheapest, is sometimes used in the shells of boilers. Its tensile strength is given at 40,000 pounds to the square inch; in many cases the tests will show far greater or far less strength, according to the quality of pig used. The tensile strength of "shell" is 45,000, and "C. H. No. 1 flange" and "fire-box" 50,000 pounds. The higher grades are seldom required to be tested, as it is only in shells of boilers made for marine purposes that any test is required; but in such boilers as are built under the superintendence of the United States inspectors, the allowable pressure is varied according to tensile strength and diameter of the boiler.

My experience of the brands of iron specified, and observations as to durability of boilers made by myself and others, convinces me that good material only should be used in their construction; but the word "good" has different meaning in the minds of different people. "Shell" iron is an improvement over the refined, and is extensively used for the shells of boilers, while the brand "C. H. No. 1 flange" is seldom used or required for that purpose. In many respects the "shell" brand, and even "refined" when of good quality, are better for fire contact than some of the "C. H. No. 1 flange" sold as such. One reason for this is that the last-named iron has a greater tendency to "blister" than either of the other two, and on this account boiler makers seldom recommend it. By blister I mean (for the benefit of your uninitiated readers) that plate which, from imperfect welding caused by insufficient heat, or from the impurities of the bloom, is not thoroughly united together, forming two or more pieces in the large plate not united, causing what is technically known as lamination; it will be seen that a plate of that kind, where the blister is exposed to the heat of the furnace, and the outer layer being unprotected by water, will soon show a "bulge," which, to the ordinary eye, presents some important and alarming peculiarities. When first noticed it looks simply as a spot of different color from the surrounding parts, and in a few days it begins to sag downward to a greater or lesser extent, according to the size of the imperfection. By removing the blister with a hammer and chisel, a new layer is exposed to the action of the flame, when the sagging is repeated, and this may continue until the greater part of the original thickness of plate is removed. Sometimes the imperfection may be of such a nature that on the removal of the outer skin, the course of the imperfect weld may lead to the interior of the boiler, in which case a patch must be put on immediately, while in the first case the patching may be postponed indefinitely. Where a blistered sheet is put into a boiler, and the same becomes manifest after a few weeks' or months' use, as a rule the boiler builder (although in reality not responsible for it) is expected to put the boiler in proper repair without expense to the purchaser. If objections are made by him, he is informed that the boiler was bought in good faith and on the supposition that he was an honest man. Legal steps have been taken to compel a builder (when he refused to repair) to pay the bill of another firm who made the required repairs, and decisions favorable and unfavorable to plaintiff have been handed down from the bench.

There are brands of iron made especially adapted to the purpose for which they are intended, one mill making brands of iron known respectively as "best locomotive flange," "extra locomotive flange," and "extra locomotive fire-box." This last-named is a guaranteed iron, warranted free from blister, and is an iron that it is almost impossible to break by fair means in the processes of working

and forming. I do not think that it is in the main as good as steel plate (the cost being equal). As the steel is first cast into an ingot and then rolled, it is an uncommon thing to find a blistered plate of steel.

Twenty-five or thirty years ago there were in reality but two qualities of iron. "C. No. 1" and "C. H. No. 1" iron were then made *honestly*, compared to the manner in which they are at present made, and the cabalistic letters really meant what they said. "C. No. 1" was charcoal No. 1 iron; "C. H. No. 1" was charcoal hammered No. 1 iron; and it was a very rare occurrence to find a defective plate of either brand.

I know of boilers built by me eighteen years ago, where the shell was made of C. No. 1 iron ("shell" was then unknown), which are still in existence, and, to all appearances, are in good—I may say excellent—condition at the present time. "Refined" and "tank" iron are both made in the same way, the best plates being stamped according to the first-named brand, the rejected or poorer ones being thrown aside and called tank iron. "C. H. No. 1 flange fire-box" is that which, after rolling, has been reheated, when, if found free from traces of imperfection and blister, it is stamped "fire-box;" if blisters or other imperfections are noticed, it still remains, and is sold for C. H. No. 1 flange. Any maker of iron will, when required, stamp each plate ordered from him with the tensile strength, according to the figures already given. In addition to this, the custom is for mill men to stamp in at least three places the quality of the plate—"refined," "shell," and "C. H. No. 1 flange" respectively. These marks should be visible on each sheet. When the stamp is not visible, it gives rise in the mind of an expert to the supposition that tank iron is used, as tank iron is not always stamped—some mill men causing such plates to be stamped, while with others there is no such stamp put on. There are grades of steel plate now made especially for boiler shells; in fact, some makers have as many different varieties of steel as there are of iron, and as the cost is not much greater than that of iron, everything considered, the adoption of the steel plate is desirable if durability is considered. In addition to cost per pound, the steel, by reason of its greater tensile strength, can be reduced in thickness without materially weakening the strength of the boiler, so that, taking reduced weight at increased price over iron, the difference in actual cost is but small. As was mentioned in a former paper, there is a limit to the protection afforded by water to a heavy plate of metal; this being considered, the reduced thickness in case of steel being used is an advantage which should not be overlooked.

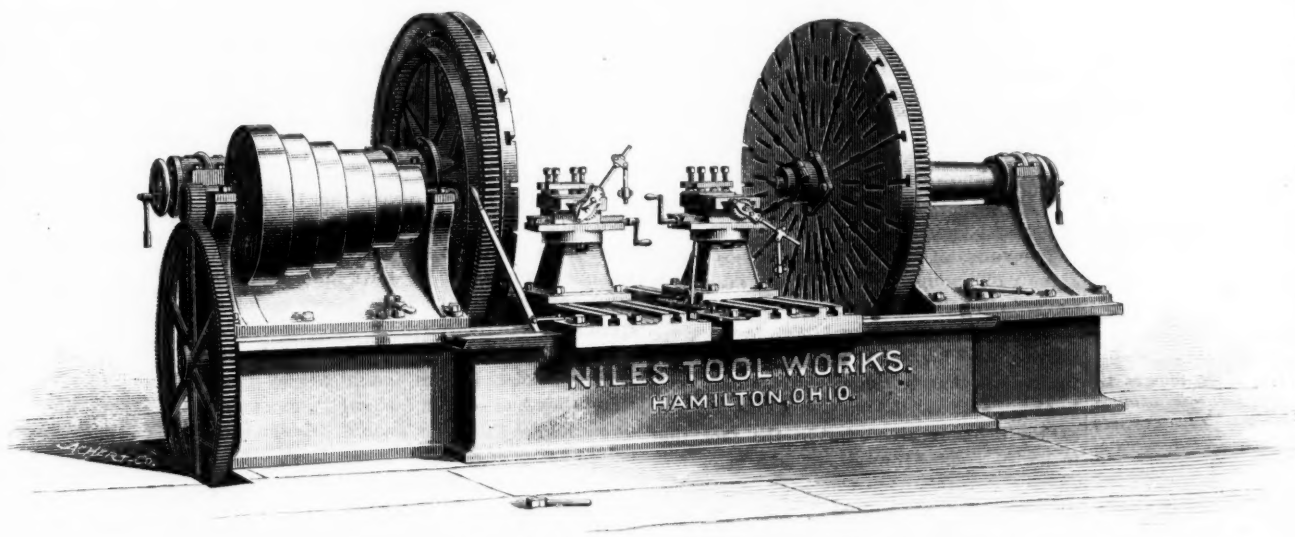
A Metallurgical Triumph.

I wonder if I could explain to the general reader how Messrs. Thomas & Gilchrist succeeded in eliminating phosphorus from iron. It always seems to me like a fairy tale. I will try: In making steel, ten tons of molten pig iron is run into a big pot called a converter, and hundreds of jets of air are blown up through the mass to burn out the silica and carbon, and finally to make it steel. Now, phosphorus has a greater affinity for lime than for iron when it reaches a certain temperature, and when the air blast brings the mass to the required heat, the million particles of phosphorus, like so many tiny ants disturbed, run hither and thither quite ready to leave the iron for the lime. In experimenting to get rid of the phosphorus, these clever young men (Thomas & Gilchrist) first put a lot of lime in the bottom of the pot as a bait, and into this fly the ants, perfectly delighted with their new home. The lime and slag float to the top, and are drawn off; but, mark you, let the temperature fall, and the new home gets too cold to suit these salamanders, although the temperature may be over 2,000 degrees—hot enough to melt a bar of steel in a moment if thrown into the pot. No; they must have 2,500 degrees in the lime, or they will rush back to the metal.

But here lay a difficulty: 2,500 degrees is so very hot that no ordinary pot lining will stand it, and, of course, the pot itself will not stand a moment. If ganister or fire-brick is used, it just crumbles away, and besides this, the plaguey particles of phosphorus will rush into it and tear it all to pieces. The great point is to get a basic lining—that is, one free from silica. This has at last been accomplished, and now the basic process is destined to revolutionize the manufacture of steel; for out of the poorest ores, and even out of puddle cinder, steel or iron much finer than any now made for rails or bridges can be obtained, and the two young chemists, patentees of the Thomas-Gilchrist process, take their rank in the domain of metallurgy with Cort, Nelson, Bessemer, and Siemens. These young men have done more for England's greatness than all her kings and queens and aristocracy put together.—*Andrew Carnegie in "Four-in-Hand in Britain."*

Double-Head Driving Wheel Lathe.

We illustrate herewith a new double-head driving wheel lathe, built by the Niles Tool Works, of Hamilton, Ohio.



DOUBLE-HEAD DRIVING WHEEL LATHE.

This lathe is designed with special reference to power and strength, to adapt it to the heavy work for which it is intended. The cut represents a lathe of 84 inches swing, capable of turning drivers 6 feet 6 inches diameter on the tread. It is shown without quartering and crank-pin boring attachment; when desired, this attachment can be furnished. It is located on the back-head, the spindle extending through the face-plate and drilling from the outside of the wheel inwards.

In order to get the greatest strength and stiffness at the point where the greatest strain is imposed, the front web of the bed is elevated, so that very short and stiff tool-posts may be used. The back web of the bed, which is not subjected to so great strains, is made low, so as to facilitate the handling of wheels in and out of the machine.

The driving cone has six steps, for a belt of six inches width.

One face-plate has internal and external gears, so that it may be driven at twelve different speeds; the right hand face-plate has external gears only, thus giving it six different speeds. The face-plates may be driven together, or separately, as desired, or at the same or different speeds.

Every gear about the machine, including the large internal and external gears on the face-plates, is accurately cut from the solid. These large face-plate gears are not cut or cast directly on the face-plates, but are separate rings bolted fast to it by a heavy flange. They are equally as strong as if cast with the face-plate, and at the same time, should any accident occur, causing the breakage of a number of teeth, the gear can be readily replaced.

The main driving shaft, which transmits the power from one face-plate to the other, is a heavy steel forging of large diameter, so as to be free from torsion, which is a fruitful cause of chatter in such machines. In this lathe the shaft is five and a half inches diameter.

The main spindles, to which the face-plates are attached, have large and long bearings. Each main spindle has an internal sliding spindle, with sufficient traverse, so that wheels may be turned on their axles with both crank-pins in place. The compound rests have automatic feeds in all directions, operated by overhead rock shaft, driven by feed disks on the ends of the spindles.

The town of Roanoke, Va., appears to possess good natural capabilities for becoming an iron-making center. While workmen were engaged the other day digging a trench for gas pipes in one of the principal streets of the city, they struck a vein of iron ten or twelve feet deep. Although the ore was said to be of excellent quality, the citizens did not think that it could be worked at that point, as the property was too valuable for building purposes.

Perforated feed pipes, having their delivery-end capped, are very pretty things in theory; but in practice, if the water used be anything but the very best, they are a source of continual trouble and annoyance. The small holes are very easily clogged with scale, and feed pumps are very frequently broken in the effort to force sufficient water into the boiler. The perforations may be stopped in two different ways: Firstly, by the formation of scale around them, which "cones down," as it is usually expressed, the hole gradually becoming smaller and smaller until it is entirely closed up. Secondly, by the lodgment in the end of the pipe of small pieces of scale, which, having been formed in the heater or some remote part of the pipe, has become detached, or "flaked off," and brought forward by the current of incoming water, and lodges in the end of the pipe in consequence of its being capped over, and gradually fills it up. In a case which occurred recently, the feed pump was twice broken in the effort to keep sufficient water in the boiler, before the cause of the trouble was suspected by the engineer in charge. A steam gauge placed between the boiler and feed pump indicated something over 100 pounds as the pressure required in the feed pipe to keep the boiler supplied with water when the steam pressure was but 60 pounds. Upon examination, by the inspector, the perforations were found nearly closed by a formation of hard scale around them. The only remedy in such cases is to remove the perforated portion of the pipe, and discharge the feed-water through the open end. If the pipes are properly arranged, no harm to the plates or seams will result, even if cold water is used; and, unless the water be quite bad, it will be sufficiently well flushed by the incoming water to keep it quite clean for a long time.—*The Locomotive.*

The Hartford Steam Boiler Insurance Company publishes a classified list of 184 boiler explosions that occurred in 1883. They killed, in all, 263 persons and injured 412. The list shows that 74 occurred in saw-mills and wood-working establishments, 17 of locomotives, and 15 of steamboat boilers. The year started off with 22 explosions in January—the largest in any month—and closed with 10 in December, the lowest monthly number. The list of explosions is the largest of any year on record.

The Worcester *Spy* says: "New boilers are being put into the Merrifield shops. Six boilers, five feet in diameter, with 16-inch flues, which were built by Otis Tufts, an early builder in Worcester, are being removed. One pair have been in constant use since 1846, and another pair since 1848." This is a remarkable term of service for steam boilers. But what is to become of the boilers taken out? Perhaps they will be painted up and sold by some second-hand machinery dealer as being only a little impaired by use, and safe to work at ordinary steam pressures.

The advantages of manufacturing establishments to cities and villages are now so widely recognized that when parties are ready to start a new shop, mill or factory, bids are often solicited from towns that want to possess the new industry. Some will offer a free site, others subscriptions to stock, and still others perhaps a larger bonus. Even old established manufactories sometimes enter the lists for bids of this kind when about to erect new works or enlarge. It is in some instances profitable to remove a shop from a town where taxes are too high, or other disadvantages are experienced, to a more favorable locality when an inducement is offered to move. But the conditions of a bonus ought to be well understood by both parties to the contract. Some time ago Spartanburg, S. C., subscribed $3,000 to the capital stock of a railroad company upon condition that the machine shops of the road should be erected at that place and remain there permanently. The shops were erected at Spartanburg, but when the road passed under the control of another road the shops were removed to Columbia. The city sued the company, and the affair has been finally compromised by the company paying the $3,000 back to the city.

When tea and coffee were extremely high in price during the war, numerous attempts were made to produce substitutes for these beverages. Those who went through the experience of swallowing weed decoctions in place of tea, and infusions from roasted corn as a substitute for coffee, agree in asserting that all experiments of this kind were miserable failures. A patentee now intends trying similar experiments on an extended and systematic scale, but he does not leave the drinker the disagreeable duty of trying to deceive himself that he is swallowing best Java when diluted bean juice is going down his throat. This enterprising inventor has patented a process by which he intends to disguise corn, barley, wheat, beans, and other amylaceous substances by means of extract of willow bark till a connoisseur cannot tell the product from real coffee.

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NEW YORK, APRIL 26, 1884.

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The Use of Books.

Nothing is more common than inquiries from young men as to what books to study to become proficient in something that others acquire a knowledge of only by years of practical experience. There seems to be a growing opinion that in *some* of the books published on subjects connected with the various trades and occupations information will be found that will supersede the old-fashioned way of attaining skill and proficiency, and this opinion is doing, and is likely to do, harm. Books are of great value, and to none more than to mechanics, and those trying to make themselves proficient in some trade or occupation, but when it is assumed that the knowledge gained from them is all, instead of a very small portion of that required, they may work positive injury; an injury, because leading to a dependence upon something from which the foundation may drop some day. This is equally true whether the books are read at home or studied at school, but at the same time it is no argument against either reading or studying them.

No one would be quite so foolish as to trust himself in water forty feet deep because he had read all that was ever written on the art of swimming, but what is written might be of advantage to him in learning to swim. And yet it is, apparently, frequently expected that book knowledge can supply the place of practice in regard to matters much more difficult to master. As showing how this is sometimes looked at, an engineer relates the instance of a young man, fresh from school, recommending himself as in every way competent to run a locomotive, not from any practical knowledge whatever of locomotive running, but from information gained by the study of a book on the subject. At the same time the author of the book referred to was free to express regret that he could not run a locomotive, as a practical knowledge of all the details would be of great benefit to him in writing upon the subject.

The value of knowing how to do something well enough to get paid for doing it is never better illustrated than when a young man finds himself obliged to go to work for a living, and has no other recommendation for a job than a knowledge gained from books. And yet the fault is not in the education he has received, but in the fact that he has persuaded himself, or has been persuaded, that this education is all he requires to fit himself for successful practical work. There is a wide difference between getting useful information from books, and expecting to get all the knowledge of a subject that is required from them; that is, any mechanical or industrial subject.

Adopting Improvements.

Ever since the application of machinery to industrial purposes became general, the printing press has been the object of special attention among inventors. Many of the most ingenious mechanical contrivances ever invented for facilitating production have been brought out connected with the printing press, and the machine has reached a wonderful degree in the line of perfection; yet the race of improvement proceeds now as vigorously as ever. During last year nearly one hundred patents were granted applying to printing presses. Although, perhaps, the majority of these inventions are impracticable, the labor displayed shows the tendency of invention. Those who labor in this line do not spend their time without having well-founded hope of reward, for users of printing presses have proved themselves commendably ready to adopt new inventions that are likely to enhance the efficiency of their machinery. The competition in newspaper business is so close that the most enterprising publishers are constantly on the look-out for improvements that will enable them to beat their rivals. This often compels the men engaged in newspaper work to throw out good machines that are little worn, to replace them with others possessing improvements that give too much advantage to a rival. The sacrifice of capital in this way is said to be enormous. From the *Paper World* we learn that a New York daily newspaper publisher some time ago bought from Hoe & Co. presses for $300,000. Improvements since these machines were made have rendered them so comparatively unserviceable that recently they were taken out and replaced by the best machines of present construction. An allowance of only $1,250 was made for the replaced machines, being little more than the price of so much old iron. Although it would hardly pay men engaged in ordinary machine-work to follow the example of publishers, and replace machines merely because they had grown out of date, there are many who would save money by relegating to the scrap heap decrepit tools that produce inaccurate work at inordinate expense.

We find the following item in several of our Texas exchanges:

"Wichita Falls shipped last year 206,000 pounds of wool, which was sold for $3,708,000."

We have always heard that Texas is a great sheep raising State, but heretofore very few reliable statistics have been published about the profitableness of the industry. Wool at $18 a pound ought to pay a sheep farmer for his labor. Northern wool sells at a much lower price. Either Texas wool must be extra superfine or the Texas papers are trying to make up a case against the protective tariff by drawing attention to the high price paid for "raw material." What an argument in favor of free trade could be drawn from a suit of clothes made from native eighteen dollar wool!

Many old mechanical devices are patented and are bringing in fat revenues to the patentees. In numerous instances royalties are paid on patented articles because the users prefer to spend their money in that way rather than in the law courts, although they are perfectly able to prove that the device was in extensive use before being patented. Men often endure injustice rather than face the uncertainties of legal procedure. Railroad companies have been heavy sufferers from frauds perpetrated by persons obtaining patents on old devices connected with rolling stock. Parties would patent something they had seen in use about an engine or car and say nothing about it till the time of the patent was nearly expired, when they would assail railroad companies for enormous damages for infringement. A recent decision of the United States Supreme Court seems to strike a blow at this practice. The Locomotive Engine Safety Truck Company sued the Pennsylvania Railroad Company for using swing trucks upon their engines. This kind of truck as applied to cars, is nearly as old as railroad operating, yet the Locomotive Engine Safety Truck Company obtained possession of a patent, which they claimed excluded others from using the appliance on locomotives. The Supreme Court decided otherwise.

Literary Notes.

STEEL AND IRON: COMPRISING PRACTICE and Theory of the several methods pursued in their manufacture, and of their treatment in the Rolling Mills, the Forge, and the Foundry. By William Henry Greenwood: Cassell & Company (limited), 739 Broadway, New York.

This work was published in Britain, to meet the growing demand for full and accurate information regarding metallurgical processes. The spread of technical education has excited wide interest in the scientific part of common industries, and has created a demand for manuals of technology which would supply reliable instruction on applied science. "Steel and Iron" was published as the text-book on the subject treated. Although the book is got out in a compact form, the subject is treated very exhaustively. The information that a book is a "manual" is generally accepted as a notice that it contains nothing of interest to the ordinary reader, and that it contains facts arranged in a lifeless form, that none but those specially interested are likely to wrestle through. Steel and Iron is a notable exception to the dry-as-dust method of treating technical subjects. It not only gives an immense array of facts connected with iron and steel, but it tells them in a way that attracts the reader from page to page till the five hundred and eighteen pages seem to make up a short story.

After a chapter devoted to the explanation of terms, in which tenacity, ductility, elasticity, welding, etc., are treated, and many valuable points given about the behavior of metals under various conditions, the author proceeds to explain the nature of the materials needed to withstand the terrific heat raised in reducing iron from its ores. Then all kinds of iron ore are described physically and chemically, with the numerous methods, plant, and material employed in the various processes. The practice of iron working in all countries is described, and the book gives particulars of the crudest methods still in use, but it also records details of the latest improvements in metallurgical operations, the advances of the year 1883 being well covered.

The leading operations connected with refining iron are given in a clear, practical way, that is easy of comprehension. The mind of the student is aided over the most difficult steps by engravings, taken from well-designed drawings. Although the book is essentially technical, the reader never has to re-read a sentence in order to get its meaning. We have read the book with much pleasure and profit, and we are certain that few engineers can do likewise without receiving instruction in an enjoyable manner.

DRAINAGE AND SEWERAGE OF DWELLINGS. By William Paul Gerhard. William T. Comstock. 6 Astor Place, New York. Price $2.50.

This book was formed from articles contributed to technical journals by the author, who is a civil engineer and has devoted special attention to sanitary engineering. The work shows that the author is intimately familiar with the sanitary conditions of our city dwellings, and the picture he gives of how disease is sown broadcast, through defective drainage, is far from being comfortable reading to those who are compelled to live in city houses. The author, however, knows whereof he speaks, from personal observation, and his account of the loose way the drainage operations are carried out ought to arouse our municipal authorities to closer supervision of the work, which influences so directly for good or evil the health conditions of cities. Besides knowing what kind of work entails defective drainage, Mr. Gerhard is well acquainted with the most approved methods of plumbing and drain building, which he explains by aid of numerous cuts.

AN AMERICAN FOUR-IN-HAND IN BRITAIN By Andrew Carnegie. New York, Charles Scribner's Sons.

This can scarcely be regarded as a mechanical work, but it is written by one who is a large employer of American mechanical labor, Years ago, when the prospects of becoming a leading American steel maker and millionaire seemed very remote, Andrew Carnegie made a pedestrian tour with three young companions through the downy country of Southern England. It is a delightful country for such a project; the youths were merry and determined on enjoying themselves, and they were successful. Then Andrew Carnegie declared that when his "ships came home" he would drive a party of his friends from Brighton to Inverness. His ships did reach port, and, contrary to such promises generally, he kept the word that was given in jest, and "An American Four-in-Hand in Britain" records the doings of the party. The larger party seemed to be as happy as the smaller one, and the glimpses given of what they saw and did makes the reader long to follow their footsteps. They took in some of the finest scenery, and visited many of the most noted places in Britain, the journey being made in easy stages, so that fatigue should not vanquish pleasure. The heroine of the party is the venerable mother of the author, whose tenderness to-

ward her is very touching. In the course of the journey they visit the ancient town of Dunfermline, in Scotland, where Mr. Carnegie was born, and towards which he has proved a benefactor since his rise to affluence. Here the party received a princely welcome, their visit being made the occasion of a holiday and jubilee among the natives.

The book was not originally intended for the public. It is written in an easy, unassuming style, yet it contains many wise words and sparkles with quiet Scotch humor. Numerous expressions in the book testify how thoroughly Andrew Carnegie has identified himself with the sentiments of his adopted country. Had the author not been successful in commercial business, we believe he might have made his mark in literature.

QUESTIONS AND ANSWERS.

Under this head we propose to answer questions sent us, pertaining to our specialty, correctly, and according to common sense methods.

Every question, to insure any attention, must invariably be accompanied by the writer's name and address. If so requested, neither name, correct initials, nor location will be published.

(175) C. O. W., Moravia, N. Y., asks: Does an ordinary fan require more power to drive it when the wind is shut off in the exhaust pipe? *A.*—Generally speaking it does.

(176) J. G. H., Lawrence, Mass., asks: What is the proper way to finish and polish the surface of hard rubber? *A.*—Hard rubber may be cut and finished like wood. Those who do much work in that substance very likely have some special processes, with which we are not acquainted.

(177) R. J. S., Petersburg, Va., asks: 1. Will a steam pump supply a boiler working under 75 to 80 lbs pressure, and at the same time discharge water under 47 lbs. pressure through a 10″ pipe? *A.*—No. 2. Why is it you cannot temper steel heated in a wood fire, and that by heating it in a wood fire it becomes worthless? *A.*—If the fire is intense enough to heat the steel reasonably quick, you can temper it from the heat of a wood fire, and it will not be worthless.

(178) J. M. T., Franklin, Tenn., asks: Do you consider it safe to blow the water in the boiler down to the lower gauge cock, while the engine is running? *A.*—That depends upon where the lower gauge cock is located. Generally this cock is placed so that there is no danger of burning the boiler, so long as water shows at it, in which case there would be no danger in blowing down to it, provided your pump is all right, and will more than supply the boiler. One of the first things an engineer should find out is, if there is water on the heating surfaces of the boiler when the water is down to the lowest gauge.

(179) F. J. H., Cincinnati, O., asks: 1. Which end of a two-flue boiler should be set the highest? *A.*—We think you will get as good results to set the boiler level. 2. What effect has water in the ash-pit of a boiler in use, and when not in use? *A.*—It may sometimes serve to keep the ash-pit a trifle cooler when the boiler is in use; some think that the vapor from it assists combustion, but we do not share in that belief. When the boiler is not in use its effect will be a little in the direction of causing some of the iron work to rust. 3. What part of the safety valve is called the fulcrum? *A.*—The center of the pin or bolt, or knife-edge, usually at the end of the lever.

BUSINESS SPECIALS

Transient Advertisements, 50 cts. a line for each insertion under this head. About seven words make a line. Copy should be sent to reach us not later than Wednesday for the ensuing week's issue.

Gears—G. B. Grant, 3 Alden st., Boston; water motors

Presses & Dies, Ferracute Mach. Co., Bridgeton, N. J.

Steel Name Stamps, &c J. B. Roney, Lynn, Mass.

Metal & Wood Patterns—G. D. Lambert, N. Haven, Ct.

INVENTIONS perfected, designed, or patented. E. P. Robbins, M. E., Cincinnati, O.

For first-class machine patterns and estimates, address John Valentine, 15 Alling st., Newark, N. J.

"How to Keep Boilers Clean." A book mailed free, by James E. Hotchkiss, 86 John street, N. Y.

Fine tools and special machinery. Horace Thurston, 84 Clifford street, Providence, R. I.

Lyman's Gear Chart. How to lay out gear teeth. Price 50 cents. E. Lyman, C. E., New Haven, Conn.

Wood Engraving done in best manner. Designs furnished. Edward Sears, 48 Beekman St. New York.

Foot Power Machinery, for workshop use, sent on trial if desired. W. F. & John Barnes, Rockford, Ill.

The latest Improved Tack and Match Machinery is made by White Machine Co., Waterbury, Conn.

Patents.—Franck D. Johns, Att'y at Law & Solicitor of Patents, 617 Seventh St., Washington, D. C.

Pattern and Brand Letters. Vanderburgh, Wells & Co., corner Fulton and Dutch streets, New York.

Consulting Engineer and Mechanical expert, C. C. Hill, 84 Market street, Chicago, Ill.

R. Dudgeon, 24 Columbia st., New York, Improved Hydraulic Jacks and Roller Tube Expanders.

Herbert W. T. Jenner, Mechanical Engineer and Solicitor of Patents, 626 E st., Washington, D. C.

Guild & Garrison's Steam Pump Works, Brooklyn, N. Y. Steam Pumping Machinery of every description. Send for catalogue.

Improved Tack Machinery, made by The Willets Man'f'g Co., can be seen in operation at their works, 57 Clifford St., Providence, R. I.

The "Wax Process" Engravings shown in the AMERICAN MACHINIST each week are made by Struthers, Servoss & Co., 32 Frankfort Street, N. Y.

New Books, relating to steam, the steam engine, mechanics, machinery, and engineering. Send for catalogue. Fred. Keppy, publisher, Bridgeport, Conn.

Engine Lathes, Hand Lathes, and other fine tools. Assortment large: prices low. Frasse & Co., 62 Chatham St., N. Y.

For copies of the AMERICAN MACHINIST, dated January 22d, 188', clean and in good condition, we will pay 25 cents each. AMERICAN MACHINIST Publishing Company, 96 Fulton street New York.

The Complete Practical Machinist, $2 50; the Pattern Maker's Assistant, $2.50; Mechanical Drawing Self-taught, $4 00; books for practical machinists. Address, Joshua Rose, Box 3,306, New York City.

BOUND VOLUMES of the AMERICAN MACHINIST for 1880, 1881, 1882, and 1883, for sale at $3 50 per volume, express charges to be paid by purchaser. AMERICAN MACHINIST Pub. Co., 96 Fulton Street, New York.

"Painting and Painters' Materials."

The best book for all who paint, deal in paint, or have painting done. $2 25. For sale by "The Railroad Gazette," 73 Broadway, New York.

Engineers will find that their rods will keep smoother, and not have to be packed so often, if they will use the Selden patent "Rubber Core" packing. It is manufactured by Randolph Brandt, 38 Cortlandt street, New York.

EXTRACTS FROM CHORDAL'S LETTERS, 400 pages, 12mo., handsomely bound in cloth. New and enlarged edition, with over 50 illustrations. Price $2. Published by John Wiley & Sons, 15 Astor place, New York.

Useful Information for Steam Users—A 100-page pamphlet, compiled from the best authorities, on the care and management of the steam engine and boiler, with hints and rules for engineers and firemen. Engineers everywhere should have this work. Send 25 cents in P. O. stamps for a copy. The J. N. Mills Publishing Co., 145 Broadway, N. Y.

For sale—Well guarded, pleasant, permanent, thoroughly endorsed and exceedingly profitable manufacturing business. Wanted in every city or locality where boilers and engines are used. Twenty-four hours will equip and manufacture goods. One room, ten feet square. Owner wants no help, no power. Very little knowledge of engines and boilers required. Baltimore City not for sale. Entire capital required, $300 to $600. Don't fail to write for circular, Stationary and Marine. P. O., Baltimore, Md.

MANUFACTURES.

William N. Seay, Amherst C. H., Va., is to start a new machine shop.

Roger Williams, Lexington, Ky., will double the capacity of his foundry.

Murray & Stevenson, Anniston, Ala., will double capacity of their foundry.

A new thread-mill is to be started in Burlington, N. J., by Charles P. Farmer.

Boiler shop is to be added to the Calera (Ala.) Foundry and Machine Shop.

Jasper Cairns will erect a four-story factory at 400 Broome street, New York.

Wiggins & Simpson have nearly completed an iron foundry at Huntsville, Tex.

R. S. McFarlin & Co., Lagrange, Ga., will build a plow factory and a cotton-seed oil mill.

Gotfried Brungies, 129 9th street, Brooklyn, N. Y., will erect a new three-story wagon factory.

The New York, New Haven and Hartford Railroad is building a new roundhouse at Hartford, Conn.

R. H. Wolff, 93 John street, New York, is building a new wire factory in the upper part of the city.

The Columbus Oil Mill Company, of Columbus, Ga., will build a cotton-seed oil mill at Macon, Ga.

J. D. Lowe, of Columbus, Ga., and others, have bought land at Macon, Ga., to erect a large factory.

The Phœnix Tin Company are arranging to build a new factory at the foot of 6th street, Brooklyn, N. Y.

J. H. Gill and R. D. Stewart, of Raleigh, N. C., will start a foundry and machine shops at that place.

The Cummer Engine Company, Cleveland, O., is about to add an extension of 150 feet to its main building.

The South now has three hundred and fifteen cotton mills, against one hundred and eightyfour years ago.

Mrs. Mary Smith, 136 West 122d street, New York, will erect a five-story factory on 28th street, near Seventh avenue.

The *Utica* (N. Y.) *Observer*, recently burned out, are to erect another building immediately, with engines, boilers, and presses.

The Phœnix Tinware Works, 88 Tribune Building, New York, are to erect a new factory, in Brooklyn, four stories high.

The Bowdoin Paper Company, Topsham, Me., are to enlarge their machine shop and build an addition to their paper mill.

The Alabama Great Southern Railroad has surveyed ground in Birmingham, Ala. for the new machine shops of the road.

Cuthbert Brothers, 58 Baxter street, New York, are to erect a six-story brick factory, at 311 West 40th street, to cost $16,000.

New water works are to be built at Rome and Conestoga, N. Y.; Rock Island, Ill.; Sweetwater, Albany, and Victoria, Tex.

William Nelson, 24 Old Slip, New York, will erect a six-story brick factory, 70x38 feet, at 5, 7, and 9 Mulberry street, to cost $15,000.

The main building of the recently completed Portsmouth, N. H., machine shop is 204 feet long, 70 feet wide, and two stories high.

The capacity of the new three-story mill, which Stevens Brothers will shortly build at Greenville, Tenn., will be two hundred looms.

The report in some papers, that the Herring Safe Company, of New York, will start a branch factory in the South is without foundation.

George M. Eddy, manufacturer of measuring tapes, 351 Classon avenue, Brooklyn, N. Y., will erect a three-story brick factory 50x32 feet.

The Baragwanath steam jacket feed-water heater has recently been attached to the boilers of B. Haxtun, and of D. C. Newell & Sons, New York.

The Toledo Wrench Company, which also manufactures switch-stands, is considering the feasibility of establishing a factory in Indianapolis, Ind.

An effort is to be made to secure the erection of a railway car manufactory at Dover, N. H. Ten men have subscribed $1,000 each toward the enterprise.

O. F. Hawley, dealer in lumber, corner Kent avenue and Rodney street, Brooklyn, N. Y., is having a new boiler and engine built by James Bulgar, of same city.

A new street railroad is to be built in Waco, Texas. M. D. Herring, J. L. Dyer, J. P. Garland, and others have subscribed for the stock, which is mostly taken.

The Hoboken (N. J.) Horse Railroad Company have decided to build a new elevator for raising cars to the Heights. An engine of 300-horse power will be needed to do the work.

The Ansonia Clock Company, 11 Cliff street, New York, have just purchased five acres of ground, at East New York, L. I., upon which they will undoubtedly erect a large factory.

William Gorrey is laying the foundation for a large building, for the manufacture of agricultural implements, which will be run in connection with his foundry, at Willimantic, Conn.

The Raleigh and Gaston Railroad Company are enlarging their machine shops and building a new foundry at Raleigh, N. C. B. R. Harding is superintendent of machinery, with office at Raleigh.

New works, to be called the Western Bridge and Iron Works, are being established at St. Louis, at the corner of Kosciusko and Trudeau streets. Messrs. Breden & Chapman are the proprietors.

William H. Brooks and Frank Cathcart have organized the Eureka Bolt Works, at Alexandria, Va. It is proposed to make the capital $300,000. They have already bought $10,000 worth of machinery.

A new Masonic temple and a new hotel are to be built in Syracuse, N. Y., this summer. Both will have boilers and engines. The latter will cost $150,000. It will have electric lights and be heated by steam.

The Lima (O.) Car Words sued twenty-four citizens, to obtain balance of money subscribed as an inducement to locate the works at that place. The car company won the suit, which involved a large sum of money.

One hundred and twenty-five thousand dollars has been raised for a cotton mill at Knoxville, Tenn., a site purchased, and building will be commenced very soon. A large woolen mill in the same city is also probable.

The Wolff Manufacturing Company, Chicago, have started to erect a 75x100-foot five-story addition to the manufactory of plumbers' supplies. When completed (about September 1) two hundred more men will be employed.

Messrs. G. F. Anderson and A. J. Fox, of Niles, Mich., and others, will build a 100-ton furnace, large car works, and a stove and plow factory at Calera, Ala. Land has been purchased from Mr. J. D. Hardy. —*Baltimore Manufacturers' Record.*

The buildings lately abandoned by the Pennsylvania Tube Works, on Herr's Island, near Pittsburgh, Pa., will be used as a place for the manufacture of machines for making ice. James and Joseph Bishop are at the head of the enterprise.

It is rumored that the operatives of a large barb-wire establishment in this city are contemplating the formation of a co-operative company from among themselves, and the establishment of an extensive barb-wire manufactory.—*St. Louis Age of Steel.*

The Savannah, Florida, and Western Railroad is about erecting large shops—division shops at Waycross, Ga., the main shops remaining in Savannah. The Brunswick and Western Railroad *may* erect shops at Waycross, but it is not yet fully determined upon.

The "Always Ready" Wrench Company was reorganized at Eliot, Me., recently, the capital stock on the new basis being placed at $150,000, in shares of $5 each. The wrench is manufactured from prepared steel, forged, tempered in oil, polished, and nickel plated.—*Mining and Industrial Journal.*

The works of the Universal Plow Company, of Canton, O., employing one hundred men, are to be removed to Muncie, Ind. The citizens give the company two acres of ground near the railroad, and pledge themselves to place $6,000 in bank, to be paid to the company when the buildings are complete and machinery in shop.

The Fitchburg (Mass.) Railroad has nearly completed the negotiations for a large tract of land near Roberts Crossing, Waltham, where it proposes to erect car houses and repair shops. The Watertown branch track will also be extended from its present terminus, at the main depot in Waltham to this point, and all the trains thereon be started there.

The Lima Machine Works, Lima, O., builders of the Shay logging locomotives, are experiencing a demand for these engines larger than their present extensive plant will meet. They are building a brick L, 180 by 40 feet, two stories high, to be used for an erecting and paint shop. They have run ten hours a day the year round, and sometimes twelve hours.

I. B. Davis & Co., Hartford, Conn., are building Berryman feed-water heaters, as follows: A 24″ heater to go to Philadelphia, a 22″ to go to Chicago, a 27″ to go to Michigan, a 32″ to go to same State, a 30″ to go to New York City, and a 20″ to go to Boston. These heaters are very durable and give good satisfaction. This firm will bring out a larger size of their power pumps.

William Frech, of Chicago, is building an automatic coiling machine for making spiral springs, of all sizes, for a firm in Pittsburgh, Pa., and has just started on an order for half a dozen Monitor lathes for different parties. He has also received an order from the East for an automatic die-grinding machine, and has recently perfected a very ingenious springometer.—*Industrial World.*

The Manning Novelty Company, a corporation with a capital of $10,000, has been organized at Youngstown for the purpose of manufacturing hardware novelties. The stockholders of the new company are W. H. Baldwin, Tod Ford, T. F. Woodman, C. H. Gileman, F. S. Presbery, W. P. Manning. Mr. Manning was elected superintendent, and Tod Ford treasurer. Works are to be erected at once.

The Eureka Mower was formerly manufactured in Poughkeepsie. Citizens of Utica, N. Y., are anxious that the machine shall be manufactured in that city, and have subscribed $6,000 to purchase a site for the company. The plans for the buildings to be erected provide for a store house 60x300 feet, a machine shop 30x300 feet, a foundry 60x150 feet, a chipping and grinding building 60x120 feet, and a wooden-work building 60x80 feet.

The Boston *Commercial Bulletin* says: Articles of association have been drawn up by Hartford and Wallingford, Conn., parties for the organization of a stock company for the manufacture of cotton goods, and the new company will locate at Wallingford. The capital stock is to be $100,000, and already nearly $70,000 has been subscribed toward it. Work will begin on the factories the coming summer, land having been secured near the Wilson sewing machine shop. The mills will employ about one hundred hands to begin with.

The H. W. Johns Manufacturing Company, 87 Maiden Lane, New York, have brought out a new article of asbestos manufacture in the way of asbestos tape, varying in width from 5-16″ to 1¼″. This is furnished, either made into gaskets or in long lengths, to be cut up as desired. It is very easily cut up and joined for gaskets for cylinder heads, steam chests, pipe flanges, or, in fact, for any purpose for which packing is required. From samples left with us, we should judge it to be a superior article, and very convenient for use.

The Billings & Spencer Company, Hartford, Conn., say they hear considerable talk about dull business, but have not yet experienced any of it themselves. Their shops are full of work, on forgings and drop forged tools. An addition of 35x80 feet is being equipped with machinery as required. Over 40,000 of Billings' pocket wrenches have been sold, and the demand is so well sustained that they have brought out a larger size, also a double-header. They are making a new hand vise for telegraph linemen which is an improvement over those imported. In a visit to these works last week, we noticed the drop forging of some large flat wrenches, for the Baldwin Locomotive Works. They were forged in two parts and welded together, being too large for a single die.

The Pratt & Whitney Company, Hartford, Conn., are fairly busy in all departments. They have recently brought out a new pulley lathe for turning, boring, and facing hubs at one operation. They have materially improved their bolt-heading machine. One of the objects of particular interest in these shops is a new machine for making watch screws. Another new and original machine just completed is for milling valve bodies. It has all the motions required for that kind of work, and all the different speeds. It will finish up stop valves with 2½″ diameter of flange, and it is calculated to do the work eight or ten times as rapidly (with only one man operating it) as it can be done on a lathe. It is automatic in every operation, and, although geared outside and inside, makes very little noise when running. This machine was built for the Pratt & Cady Company, and when it goes into practical use its results will be watched with great interest. The Pratt & Whitney Company have recently made a paper bag machine for a Pennsylvania establishment, that will make 115 to 120 bags a minute. We noticed in these shops a new cotton gin that works without a saw, thereby not tearing the fiber. They have just placed upon the market a No. 1 Renshaw ratchet, that takes drills 1/8″ to 1/2″, and weighs 18 ounces; it feeds 1¼″. They are fitting up to make reamers, both straight and taper. In going through the shops we noticed some staybolt taps 54″ long and 1⅛″ diameter, that were very accurately made and tempered. A new department of their business is the making of solid corundum wheels. R. J. Costain, an experienced man, has charge of this work. Sizes up to 22″ diameter are now being made of pure corundum without any mixture of emery.

Machinists' Supplies and Iron.

New York, April 10, 1884.

The demand for boiler-makers' supplies continues very quiet. The demand for boiler plate for boiler-making purposes is very limited. The principal call for plate iron is for bridge building and other structural purposes, but these lines are depressed. Prices are unchanged.

Boiler Plate—Tank iron.....2 4-10 to 2⅝c.
Refined.....2½ " 2⅝c.
Shell.....2¾ " 3c.
Flange.....3¾ " 4c.
Extra Flange.....4⅛ " 4⅝c.
Fire Box.....4½ " 4¾c.
Chester Steel.....4¾ " 5½c.

Some supply dealers say the demand for machinist supplies has been rather better for the first quarter of this year than it was for the last quarter of 1883, but business is by no means satisfactory. Prices are low, and buyers are disposed to hold off, to induce, if possible, still lower prices. Steam goods' trade is a little better than the other. The call for new machinery is not at all active; competition is very keen and prices rule low, but there is not a heavy stock of machinery on hand. There has been a tendency among tool makers to limit production, since the demand diminished, so that there is not likely to be any trouble experienced from a glut of the market.

The Deane Steam Pump Company, Holyoke, Mass., have published a new supplementary catalogue, which contains information about these well-known steam pumps, in convenient form. The catalogue is very neatly prepared, and will be found a useful pocket companion for users of the pump.

H. Prentiss & Co., 42 Dey street, New York, have issued a new partial list containing particulars about the leading tools which they handle.

Antimony—The market for Regulus has ruled dull. Hallett's 11c.; Cookson's, 11¾c.

Copper—There has been a moderate demand for ingot. Lake 14¾c.; Baltimore 14c.

Iron, American pig—Nothing new has developed in this market and it continues to rule dull. Dealers say that transactions are confined to a retail trade. No. 1 X Foundry, $20.50 to $21; No. 2 X $18.50 to $19.50; Grey Forge, $16.50 to $19 50.

Scotch pig—The condition of this trade is quiet Importations are light. Coltness, $21.50, to arrive, and $22 to $22.50 from yard; Glengarnock $21.50 to arrive, $22 yard; Gartsherrie, $21.50 to $22; Summerlee, $21.50 to arrive, $22 yard; Carnbroe, $20 50; Eglinton, $20.50 to $21; Langloan, $21.25 to arrive; Dalmellington, $20.50 to $21.

Lead—The market for common pig has been quite active, over 1,200 tons having been sold, from first hands, at 4c. in one day. This low price continues to be quoted.

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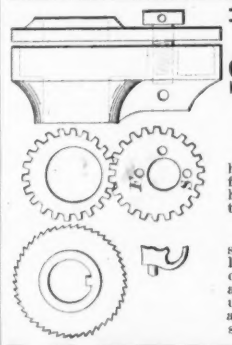
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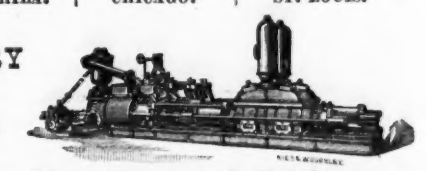
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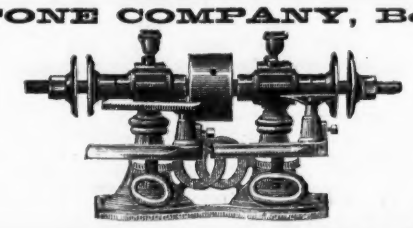
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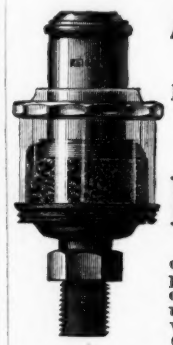
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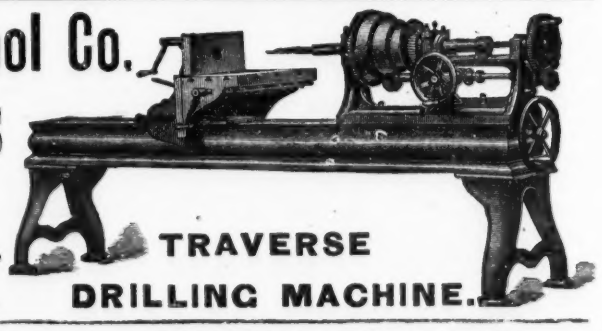
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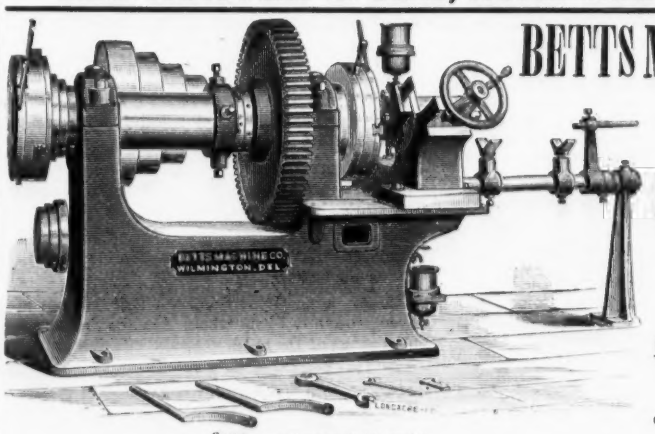

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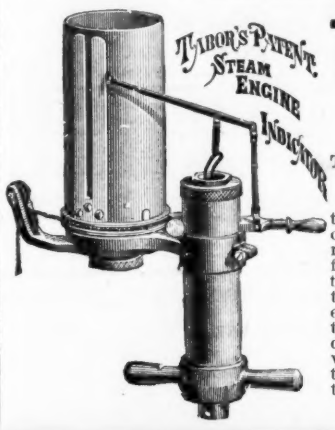

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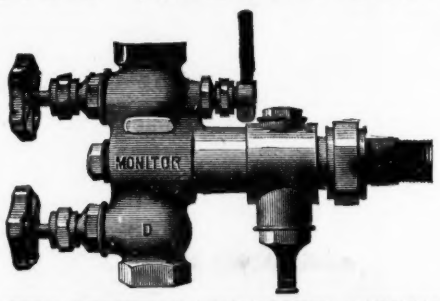

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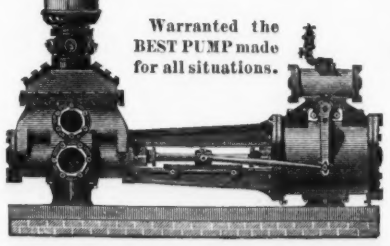

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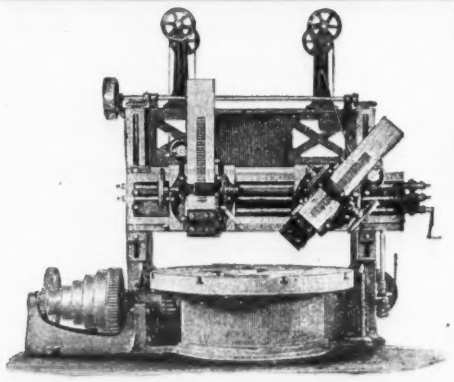

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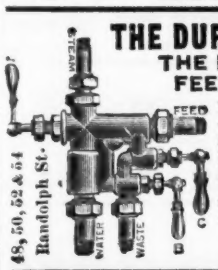

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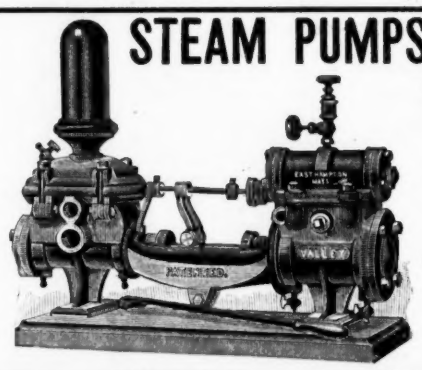

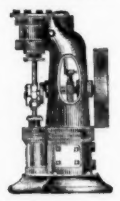

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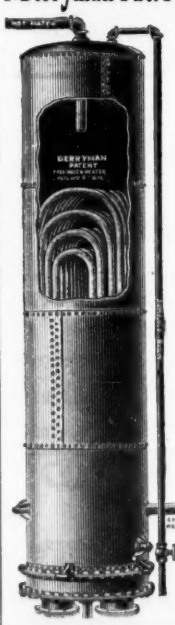

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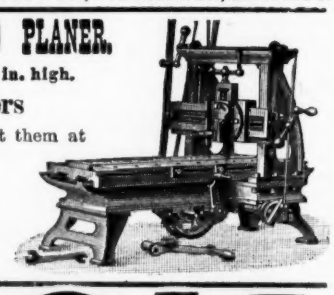

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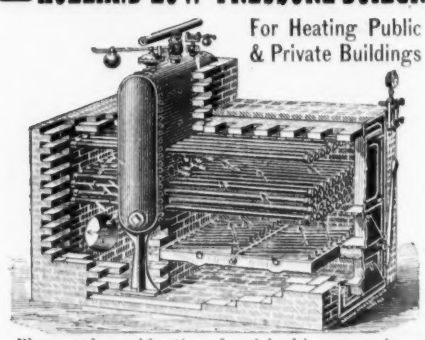

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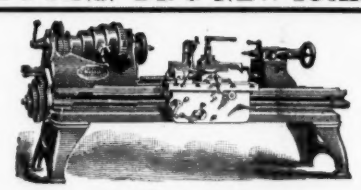

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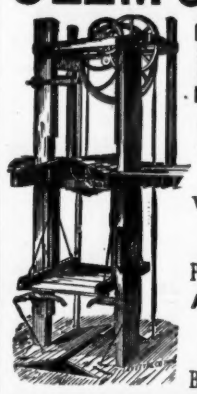

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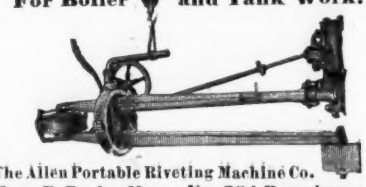

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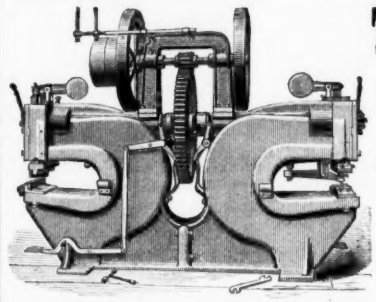

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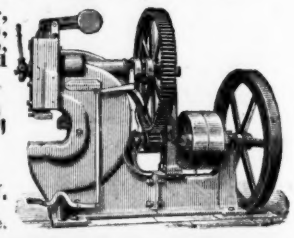

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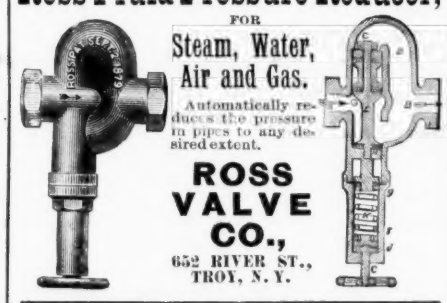

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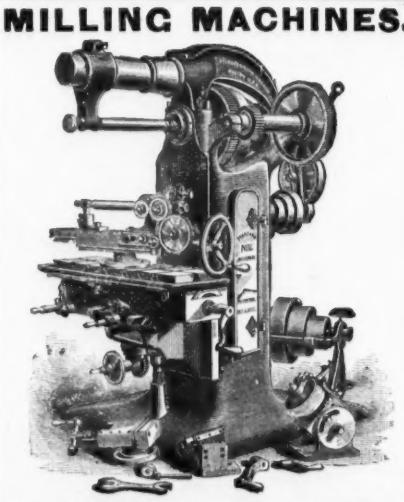

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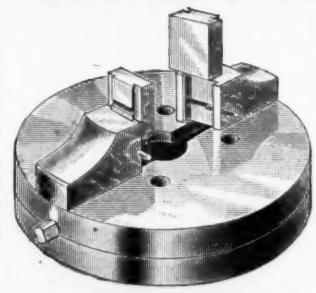

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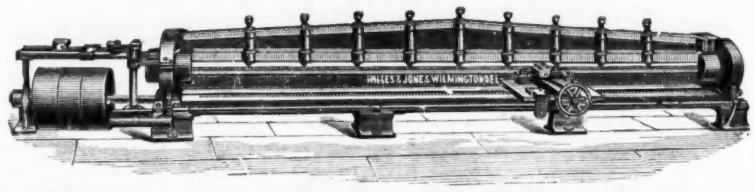

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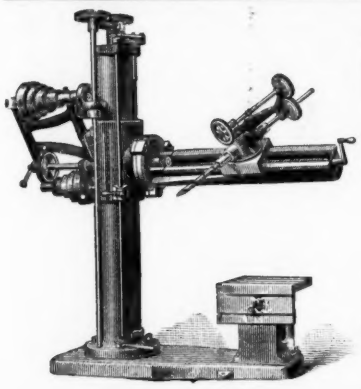

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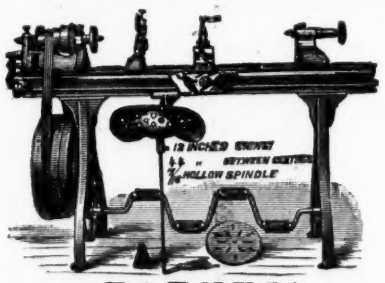

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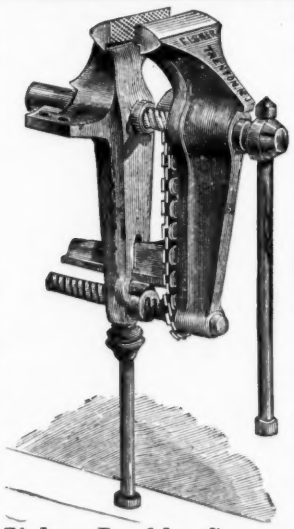

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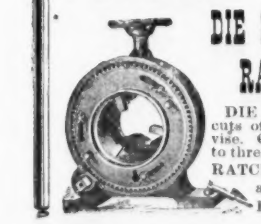

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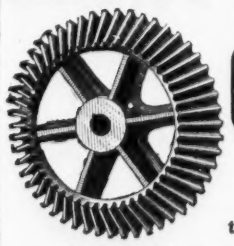

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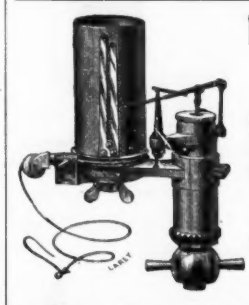

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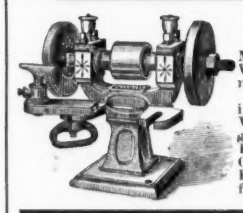

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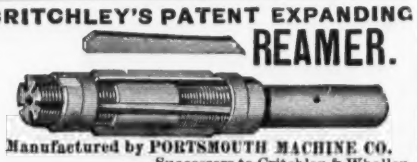

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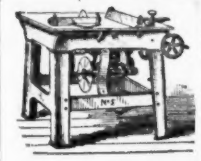

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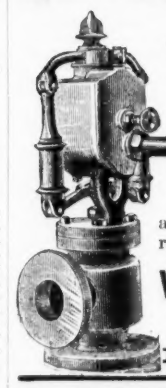

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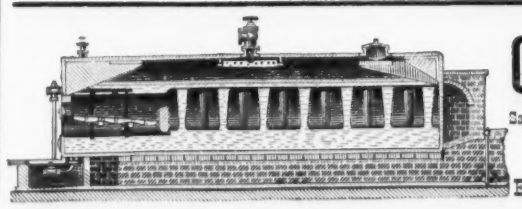

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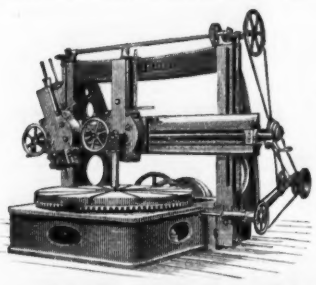

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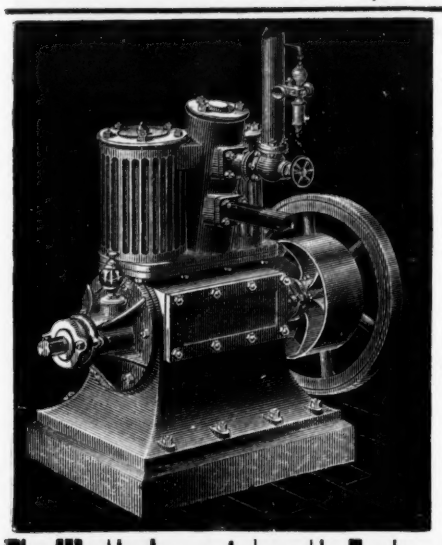

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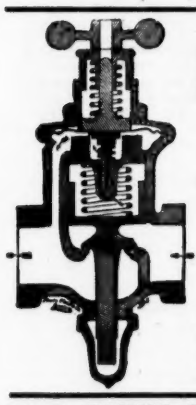

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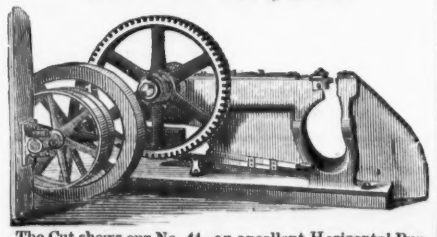

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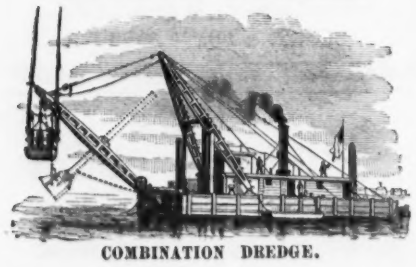

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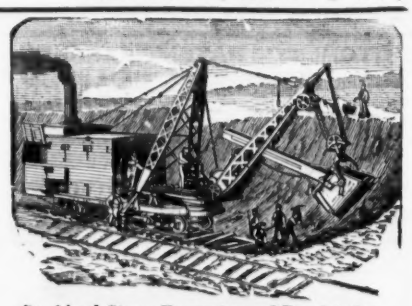

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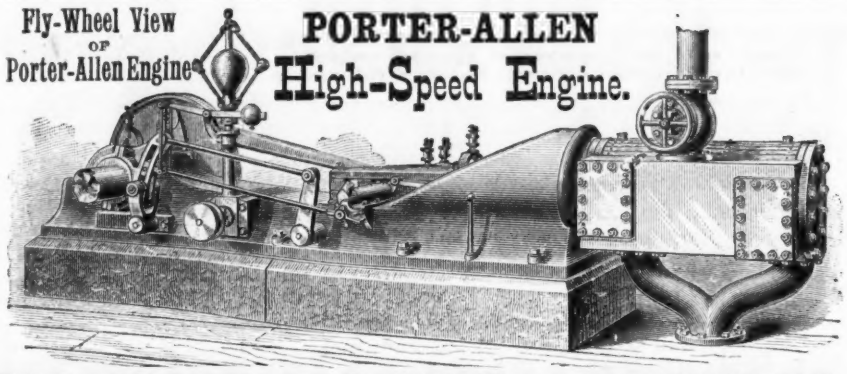

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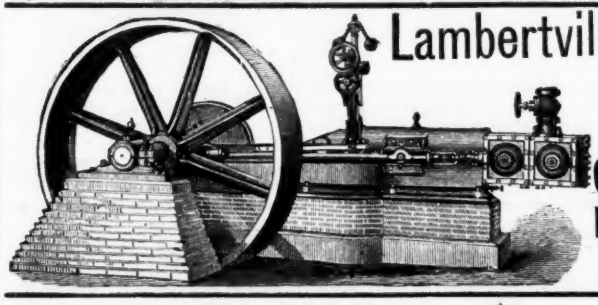

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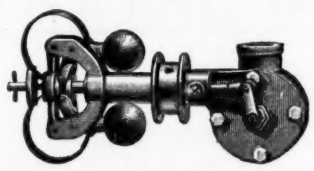

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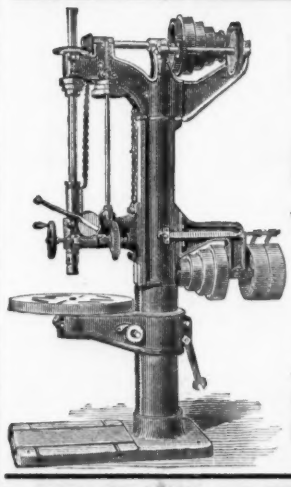

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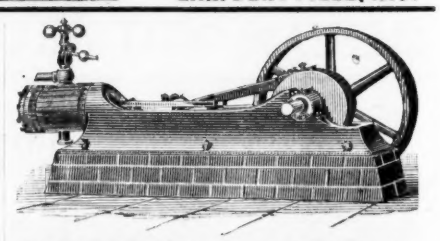

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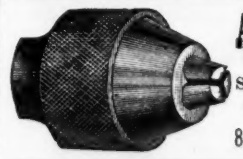

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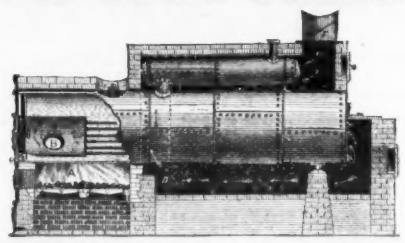

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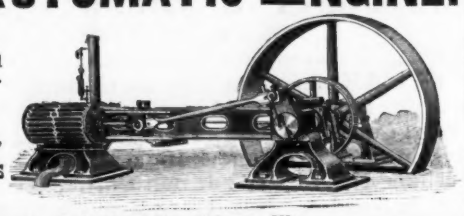

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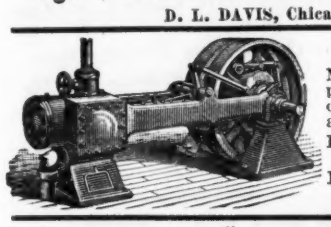

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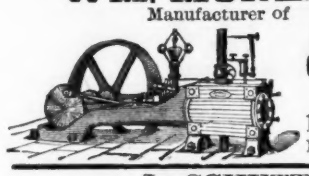

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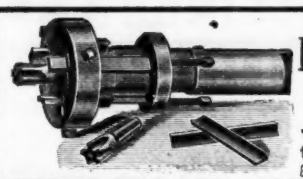

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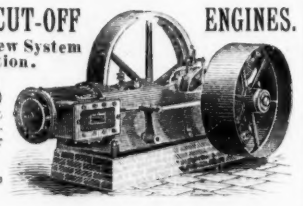

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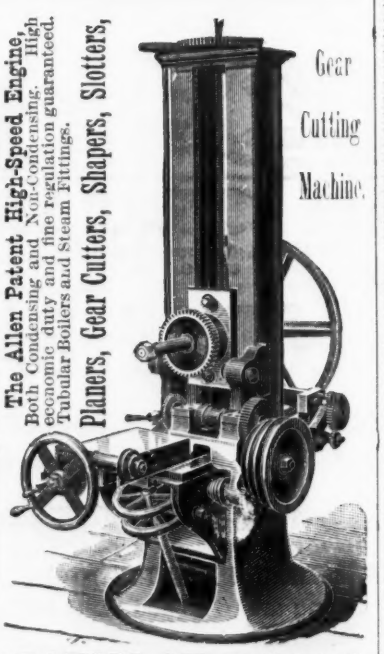

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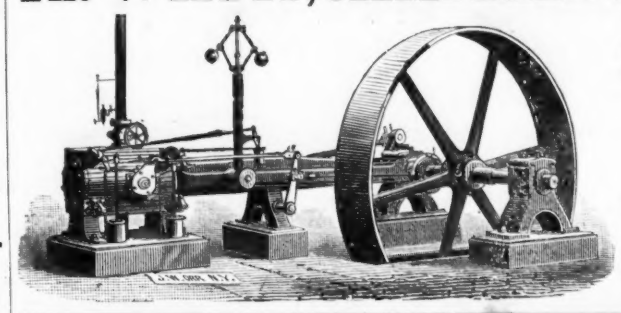

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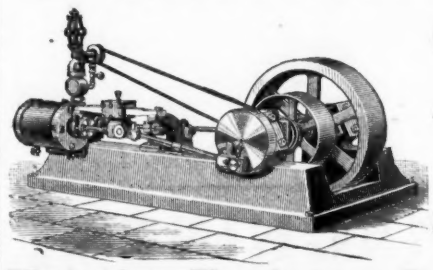

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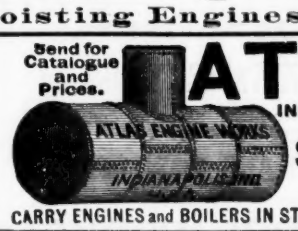

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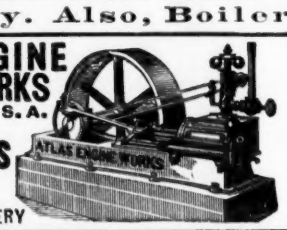

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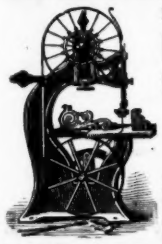

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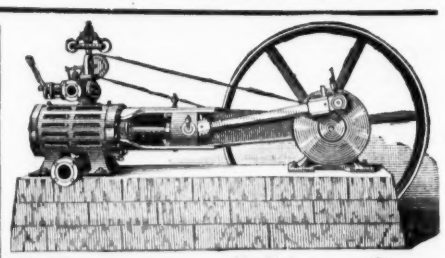

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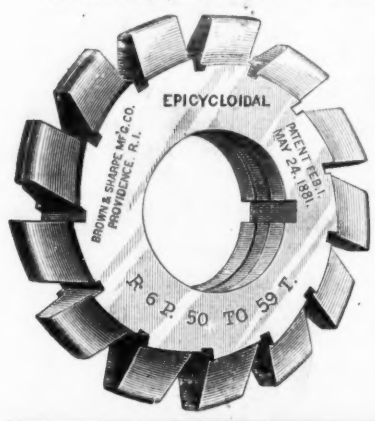

We are prepared to furnish Cutters of Epicycloidal form, which are sharpened upon the face the same as the Involute Cutters As gears of this form of teeth to run well must be cut accurately to the proper depth, that the pitch lines may coincide, we make the Cutters with a shoulder (see cut), which determines the exact depth that the gear should be cut; so that care taken in sizing the blanks obviates the necessity of any measurements in cutting the teeth. The Cutters are made for either diametral or circular pitches, and the same rules apply in finding the diameters of blanks as in our system of Involute teeth, (i. e.) 2 pitches added to the diameter at pitch line.

These Cutters will cut gears which are perfectly interchangeable. The white line on edge of the two left hand upper teeth of cut is left for the purpose of placing the Cutter central with work spindle. The Cutters are marked with letters from A to X, by which they may be ordered.

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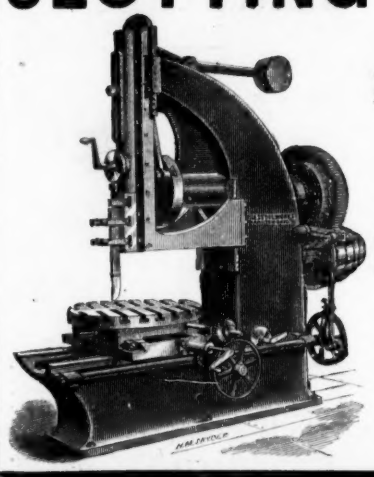

9 in., 13 in. and 18 in. Stroke. New Patterns.

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Feeds always take place at upper end of stroke—never during cut.

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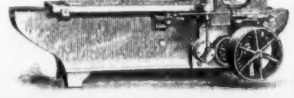

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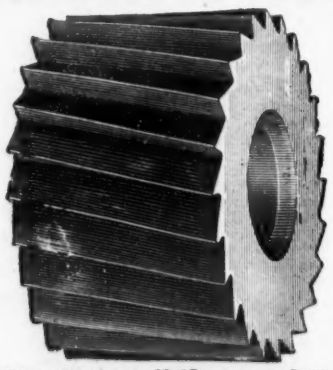

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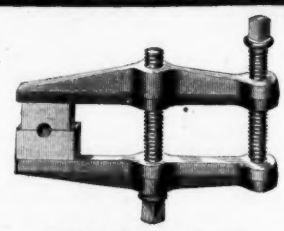

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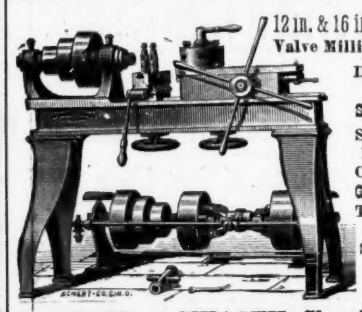

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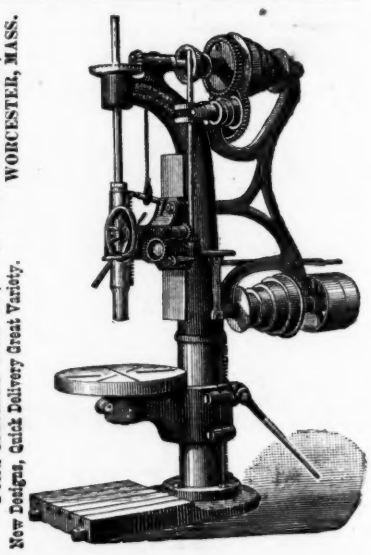

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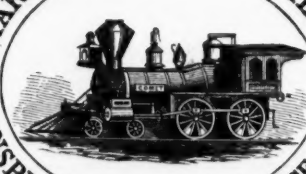

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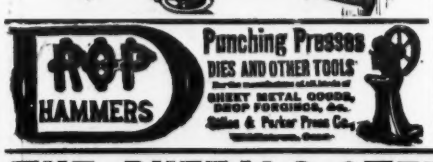

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